



2711  
B/94  
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(Case No. 99,818)

In the Application of: )  
 )  
Mark O. Vogel et al )  
 ) Examiner: Not Assigned  
Serial No.: 09/538,342 )  
 ) Group Art Unit: 2711  
Filing Date: March 29, 2000 )  
 )  
For: Method for Improved Cable Modem )  
Ranging in a Data-Over-Cable System )

**RESPONSE TO NOTICE UNDER 37 CFR 1.251**

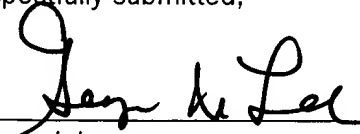
Mail Stop RECONSTRUCTION  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

We have now procured and enclose herewith the Copy of Complete Record for all  
Correspondence Between the Office and the Applicant for this application.

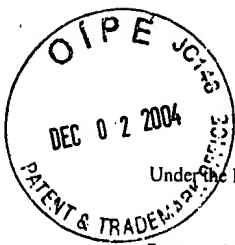
Prompt consideration of this submission is respectfully requested and a favorable  
determination is earnestly solicited.

Respectfully submitted,

  
\_\_\_\_\_  
George I. Lee  
Registration No. 39,269

November 30, 2004





Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PTO-2053-B (Rev. 10/03)  
Approved for use through 07/31/2006. OMB 0651-0031  
U.S. Patent and Trademark Office; U. S. DEPARTMENT OF COMMERCE

**In re Application of:** Mark O. Vogel

**Application No.:** 09/538,342

**Filing Date:** March 29, 2000

**Title:** Method for Improving Cable Modem Ranging  
in a Data-Over-Cable System

**Direct to:** Mail Stop RECONSTRUCTION  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

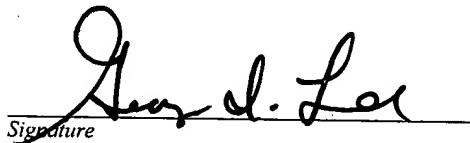
### NOTICE UNDER 37 CFR 1.251 - Pending Application

**Statement (check the appropriate box):**

- ☒ The copy submitted with this reply is a complete and accurate copy of applicant's record of all of the correspondence between the Office and the applicant for the above-identified application (except for U.S. patent documents), and applicant is not aware of any correspondence between the Office and applicant for the above-identified application that is not among applicant's records.
- ☐ The copy of the paper(s) listed in the notice under 37 CFR 1.251 is/are a complete and accurate copy of applicant's record of such paper(s).
- ☐ The papers produced by applicant are applicant's complete record of all of the correspondence between the Office and the applicant for the above-identified application (except for U.S. patent documents), and applicant is not aware of any correspondence between the Office and the applicant for the above-identified application that is not among applicant's records.
- ☐ Applicant does not possess any record of the correspondence between the Office and the applicant for the above-identified application.

November 30, 2004

*Date*

  
*Signature*

George I. Lee

*Typed or printed name*

**A copy of this notice should be returned with the reply.**

**Burden Hour Statement:** This collection of information is required by 37 CFR 1.251. The information is used by the public to reply to a request for copies of correspondence between the applicant and the USPTO in order to reconstruct an application file. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This form is estimated to take 60 minutes to complete. This time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.**





PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(Case No. 99,818)

In the Application of:

Mark O. Vogel et al

Serial No.: 09/538,342

Filing Date: March 29, 2000

For: Method for Improved Cable Modem  
Ranging in a Data-Over-Cable System

Examiner: Not Assigned

Group Art Unit: 2711

**TRANSMITTAL LETTER**

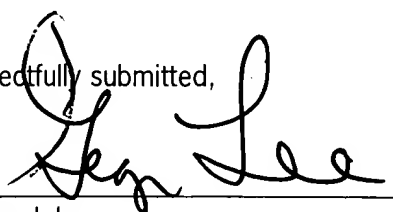
Mail Stop RECONSTRUCTION  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

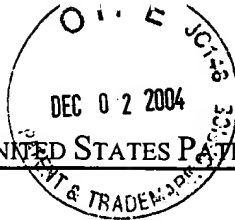
In regard to the above identified application,

1. We are transmitting herewith the attached:
  - a) Response to Notice Under 37 CFR 1.251;
  - b) Notice Under 37 CFR 1.251;
  - c) Copy of Complete Record for all Correspondence Between the Office and the Applicant;  
and
  - d) Return Receipt Postcard.
2. With respect to fees:
  - a) No fee is required.
  - b) Please charge any underpayment or credit any overpayment our Deposit Account, No. 13-2490. A duplicate copy of this sheet is enclosed.
3. CERTIFICATE OF MAILING UNDER 37 CFR § 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described in paragraph 1, are being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Mail Stop Reconstruction, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on November 30, 2004.

Respectfully submitted,

  
George I. Lee  
Registration No. 39,269





UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

20306 7590 10/26/2004

MCDONNELL BOEHNEN HULBERT & BERGHOFF LLP  
300 S. WACKER DRIVE  
32ND FLOOR  
CHICAGO, IL 60606

EXAMINER

BELIVEAU, SCOTT E

ART UNIT PAPER NUMBER

2614

DATE MAILED: 10/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

DOCKETED

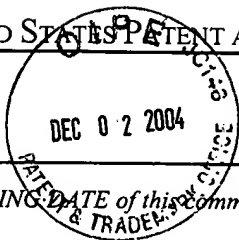
NOV 01 2004

DUE DATE 1-26-05  
BY *[Signature]*





UNITED STATES PATENT AND TRADEMARK OFFICE



UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### NOTICE UNDER 37 CFR 1.251 - Pending Application

☐ The file of the above-identified application cannot be located after a reasonable search. Therefore, the Office is initiating the reconstruction of the file of the above-identified application pursuant to the provisions of 37 CFR 1.251.

Applicant is given a period of **THREE (3) MONTHS** from the mailing date of this notice within which to provide a copy of applicant's record (if any) of all of the correspondence between the Office and applicant for the above-identified application (except for U.S. patent documents), a list of such correspondence, and a statement that the copy is a complete and accurate copy of applicant's record of all of the correspondence between the Office and the applicant for the above-identified application (except for U.S. patent documents), and whether applicant is aware of any correspondence between the Office and applicant for the above-identified application that is not among applicant's records.

☒ The following paper(s) pertaining to the above-identified application cannot be located after a reasonable search:

Therefore, the Office is initiating the reconstruction of such paper(s) pursuant to the provisions of 37 CFR 1.251.

Applicant is given a period of **THREE (3) MONTHS** from the mailing date of this notice within which to provide a copy of the paper(s) listed above and a statement that the copy of such paper(s) is a complete and accurate copy of applicant's record of such paper(s).

Alternatively, applicant may reply to this notice by producing applicant's record (if any) of all of the correspondence between the Office and the applicant for the above-identified application for the Office to copy (except for U.S. patent documents), and provide a statement that the papers produced by applicant are applicant's complete record of all of the correspondence between the Office and the applicant for the above-identified application (except for U.S. patent documents), whether applicant is aware of any correspondence between the Office and the applicant for the above-identified application that is not among applicant's records. Such records must be brought to the Customer Service Center in the Office of Initial Patent Examination (Crystal Plaza 2, 2011 South Clark Place, Arlington, VA 22202).

If applicant does not possess any record of the correspondence between the Office and the applicant for the above-identified application (or any copy of the paper(s) listed above), applicant must reply to this notice by providing a statement that applicant does not possess any record of the correspondence between the Office and the applicant for the above-identified application.

Failure to reply to this notice in a timely manner will result in abandonment of the above-identified application. The three-month period for reply to this notice may be extended (up to a maximum of six months) under the provisions of 37 CFR 1.136(a). However, failure to reply within this three-month period will result in a reduction of any patent term adjustment. See 37 CFR 1.704(b).

☐ A printout from PALM of the contents of the file of the above-identified application is included with this notice.

Direct the reply to this notice to:

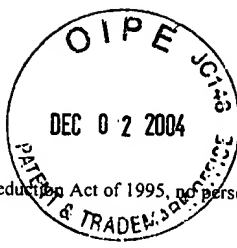
Mail Stop RECONSTRUCTION  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Direct questions concerning this notice to:

Diane TERRY  
703-305-8543

( ) -





Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

**In re Application of:** \_\_\_\_\_**Application No.:** \_\_\_\_\_**Filing Date:** \_\_\_\_\_**Title:** \_\_\_\_\_  
\_\_\_\_\_**Direct to:**Mail Stop RECONSTRUCTION  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450**NOTICE UNDER 37 CFR 1.251 - Pending Application****Statement (check the appropriate box):**

- ☐ The copy submitted with this reply is a complete and accurate copy of applicant's record of all of the correspondence between the Office and the applicant for the above-identified application (except for U.S. patent documents), and applicant is not aware of any correspondence between the Office and applicant for the above-identified application that is not among applicant's records.
- ☐ The copy of the paper(s) listed in the notice under 37 CFR 1.251 is/are a complete and accurate copy of applicant's record of such paper(s).
- ☐ The papers produced by applicant are applicant's complete record of all of the correspondence between the Office and the applicant for the above-identified application (except for U.S. patent documents), and applicant is not aware of any correspondence between the Office and the applicant for the above-identified application that is not among applicant's records.
- ☐ Applicant does not possess any record of the correspondence between the Office and the applicant for the above-identified application.

\_\_\_\_\_  
*Date*\_\_\_\_\_  
*Signature*\_\_\_\_\_  
*Typed or printed name***A copy of this notice should be returned with the reply.**

**Burden Hour Statement:** This collection of information is required by 37 CFR 1.251. The information is used by the public to reply to a request for copies of correspondence between the applicant and the USPTO in order to reconstruct an application file. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This form is estimated to take 60 minutes to complete. This time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.**





## BEST AVAILABLE COPY

Hon. Commissioner of  
Patents and Trademarks

S/N 09/538,342

Atty GIL : rrs

Re: Applicant - M. Vogel, et al.

Case No. 99-818

### METHOD FOR IMPROVING CABLE MODEM RANGING IN A DATA-OVER-CABLE SYSTEM

Dear Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

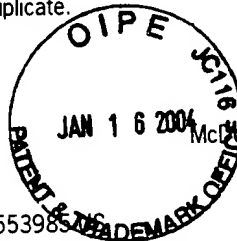
☒ Issue Fee Transmittal, in duplicate.

Fee Enclosed

\$ - 1,333.00 -

Mailed: January 16, 2004

EXPRESS MAIL NO.: EV 333553985



Respectfully,

McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant

✓





# PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax (703) 746-4000

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

20306 7590 10/20/2003

MCDONNELL BOEHNNEN HULBERT & BERGHOF  
300 SOUTH WACKER DRIVE  
SUITE 3200  
CHICAGO, IL 60606

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO, on the date indicated below.

Robin Southworth (Depositor's name)  
Robin Southworth (Signature)  
January 16, 2004 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

TITLE OF INVENTION: METHOD FOR IMPROVED CABLE MODEM RANGING IN A DATA-OVER-CABLE SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1330	\$0	\$1330	01/20/2004

EXAMINER	ART UNIT	CLASS-SUBCLASS
BELIVEAU, SCOTT E	2614	725-111000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.  
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

McDonnell Boehnen  
Hulbert & Berghoff  
1  
2  
3

## 3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the USPTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

3Com Corporation

(B) RESIDENCE: (CITY AND STATE OR COUNTRY)

Santa Clara, California

Please check the appropriate assignee category or categories (will not be printed on the patent); ☐ individual ☒ corporation or other private group entity ☐ government

4a. The following fee(s) are enclosed:

- ☒ Issue Fee  
☐ Publication Fee  
☒ Advance Order - # of Copies 1

4b. Payment of Fee(s):

- ☒ A check in the amount of the fee(s) is enclosed.  
☐ Payment by credit card. Form PTO-2038 is attached.  
☒ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 13-2490 (enclose an extra copy of this form).

Director for Patents is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.

(Authorized Signature)

(Date)

Sean D. Lee 1-16-04  
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant, a registered attorney or agent, or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, Alexandria, Virginia 22313-1450.

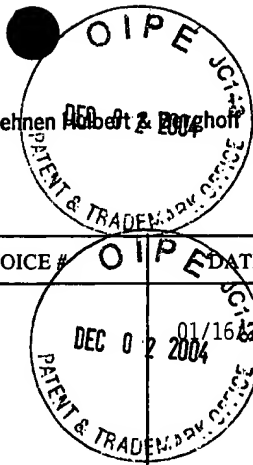
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMIT THIS FORM WITH FEE(S)





McDonnell Boehnen Hulbert & Berghoff  
Law Offices



300 South Wacker Drive  
Chicago, Illinois 60606-6709  
[www.mbhb.com](http://www.mbhb.com)

Robin

control #  
67026

312 913 0001 phone  
312 913 0002 fax

VOUCHER #	INVOICE #	DATE	INVOICE AMT	DESCRIPTION	Nº 067026 AMOUNT PAID
120768	52/638	01/16/2004	1,333.00		1333.00
Vendor ID: AS0104      Vendor Name: U.S. Patent & Trademark Office      Check Date: 01/16/2004      TOTAL CHECK: 1,333.00					

THE FACE OF THIS CHECK IS PRINTED BLUE - THE BACK CONTAINS A SIMULATED WATERMARK



McDonnell Boehnen Hulbert & Berghoff  
Law Offices  
300 South Wacker Drive  
Chicago, Illinois 60606-6709  
[www.mbhb.com](http://www.mbhb.com)

USBANK  
70477-719

Nº 067026

CHECK NO.  
67026

CHECK DATE  
01/16/2004

VENDOR NO.  
AS0104

ONE THOUSAND THREE HUNDRED THIRTY THREE AND 00/100 Dollars

CHECK AMOUNT

\$\*\*\* \*\*1,333.00

PAY

TO THE  
ORDER  
OF

U.S. Patent & Trademark Office

*[Signature]*





Hon. Commissioner of  
Patents and Trademarks  
Re: Applicant - M. Vogel, et al.

S/N 09/538,342

Atty GIL : rrs

Case No. 99-818

**METHOD FOR IMPROVING CABLE MODEM RANGING IN A DATA-OVER-CABLE SYSTEM**

Dear Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

☒ Issue Fee Transmittal, in duplicate.

**Fee Enclosed**

\$ - 1,333.00 -

Mailed: January 16, 2004

**EXPRESS MAIL NO.: EV 333553985 US**

Respectfully,  
McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant



EV 333553985 US

**Mailing Label**  
Label 11-F June 2002



UNITED STATES POSTAL SERVICE®

**Post Office To Addressee**

ORIGIN (POSTAL USE ONLY)			DELIVERY (POSTAL USE ONLY)		
PO ZIP Code	Day of Delivery <input type="checkbox"/> Next <input type="checkbox"/> Second	Flat Rate Envelope <input type="checkbox"/>	Delivery Attempt	Time <input type="checkbox"/> AM <input type="checkbox"/> PM	Employee Signature
Date In Mo. Day Year	<input type="checkbox"/> 12 Noon <input type="checkbox"/> 3 PM	Postage \$	Delivery Attempt	Time <input type="checkbox"/> AM <input type="checkbox"/> PM	Employee Signature
Time In <input type="checkbox"/> AM <input type="checkbox"/> PM	Military <input type="checkbox"/> 2nd Day <input type="checkbox"/> 3rd Day	Return Receipt Fee	Delivery Date	Time <input type="checkbox"/> AM <input type="checkbox"/> PM	Employee Signature
Weight lbs. ozs.	Int'l Alpha Country Code	COD Fee	<input type="checkbox"/> <b>WAIVER OF SIGNATURE (Domestic Only)</b> Additional merchandise insurance is void if waiver of signature is requested. I wish delivery to be made without obtaining signature of addressee or addressee's agent (if delivery employee judges that article can be left in secure location) and I authorize that delivery employee's signature constitutes valid proof of delivery.		
No Delivery <input type="checkbox"/> Weekend <input type="checkbox"/> Holiday	Acceptance Clerk Initials	Insurance Fee	<input type="checkbox"/> <b>NO DELIVERY</b> <input type="checkbox"/> Weekend <input type="checkbox"/> Holiday		
Total Postage & Fees \$		Customer Signature			
<b>CUSTOMER USE ONLY</b> METHOD OF PAYMENT: Express Mail Corporate Acct. No.			Federal Agency Acct. No. or Postal Service Acct. No.		
FROM: (PLEASE PRINT) PHONE 312, 913 0001 MCDONNELL BOEHNEN HULBERT & BERGHOFF 300 S WACKER DR FL 32 CHICAGO IL 60606-6680			TO: (PLEASE PRINT) PHONE MAIL STOP ISSUE FEE COMMISSIONER FOR PATENTS PO BOX 1450 ALEXANDRIA VA 22313-1450		
99-818 52/638 GIL:rrs					

PRESS HARD.

You are making 3 copies.

FOR PICKUP OR TRACKING CALL 1-800-222-1811 www.usps.com







# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

DEC 02 2004

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

20306 7590 12/08/2003

MCDONNELL BOEHNEN HULBERT & BERGHOFF  
300 SOUTH WACKER DRIVE  
SUITE 3200  
CHICAGO, IL 60606

EXAMINER

BELIVEAU, SCOTT E

ART UNIT

PAPER NUMBER

2614

DATE MAILED: 12/08/2003

17

Please find below and/or attached an Office communication concerning this application or proceeding.

DOCKETED

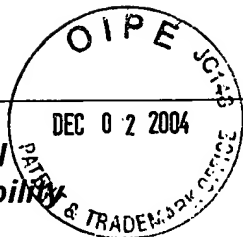
DEC 13 2003

DUE DATE:           

BY: DB



**Supplemental  
Notice of Allowability**



Application No.

09/538,342

Examiner

Scott Beliveau

Applicant(s)

VOGEL ET AL.

Art Unit

2614

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to \_\_\_\_.
2. ☒ The allowed claim(s) is/are 1-32.
3. ☐ The drawings filed on \_\_\_\_ are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
  - \* Certified copies not received: \_\_\_\_.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
  - (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No. \_\_\_\_.
  - (b) ☐ including changes required by the proposed drawing correction filed \_\_\_\_, which has been approved by the Examiner.
  - (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. \_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |   |  |
|---|--|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892)   | 5 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2 <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                 | 6 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. ____.    |
| 3 <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. <u>7</u> | 7 <input checked="" type="checkbox"/> Examiner's Amendment/Comment         |
| 4 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material              | 8 <input type="checkbox"/> Examiner's Statement of Reasons for Allowance   |
|   | 9 <input type="checkbox"/> Other   |



Art Unit: 2614

## **SUPPLEMENTAL ACTION**

### ***Information Disclosure Statement***

1. The 4<sup>th</sup> information disclosure statement (IDS) submitted on 18 November 2002 was previously considered in conjunction with the Ex Parte Quayle, Paper No. 8. However, the examiner mistakenly did not note such consideration at such time by initialing the PTO-1449. Accordingly, such consideration has been indicated on the newly attached PTO-1449.


### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott Beliveau whose telephone number is 703-305-4907. The examiner can normally be reached on Monday-Friday from 8:00 a.m. - 5:30 p.m..



If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John W. Miller can be reached on 703-305-4795. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

SEB  
December 4, 2003

  
JOHN MILLER  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2600



<b>FORM PTO-1449</b> (Rev. 2-32)	<b>U.S. Department of Commerce</b> <b>Patent and Trademark Office</b>	<b>Atty. Docket No.</b> 99,818	<b>Serial No.</b> 09/538,342
<b>FOURTH SUPPLEMENTAL INFORMATION DISCLOSURE</b> <b>STATEMENT BY APPLICANT</b> (Use several sheets if necessary)			
 		<b>Applicant:</b> Mark O. Vogel et al. <b>Filing Date:</b> March 29, 2000 <b>Group:</b> 2711	

**RECEIVED**

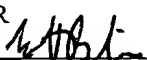
NOV 21 2002

U.S. PATENT

Technology Center 2600

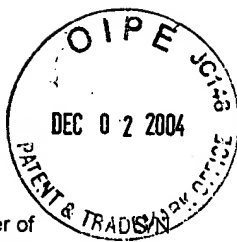
Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
567	1.	5,815,664	09-29-98	Asano	395	200.57	03-19-96
765	2.	6,032,019	02-29-00	Chen et al.	455	5.1	01-20-99
765	3.	6,442,158	08-27-02	Beser	370	352	05-27-98

**OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc).**

<b>EXAMINER</b> 	<b>DATE CONSIDERED</b> 12/4/03	

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication.





Hon. Commissioner of  
Patents and Trademarks

Re: Applicant - Vogel, et. al.

Atty EP

Case No. 99,818

Method for Improved Cable Modem Ranging in a Data-Over-Cable System

Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

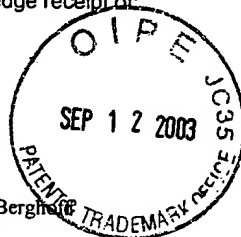
- ☒ Transmittal Letter (in duplicate)
- ☒ Amendment
- ☒ Petition for Four Month Extension of Time

**Fee Enclosed - VIA DEPOSIT ACCOUNT**

\$ 1,450.00

Date Mailed: September 12, 2003

Respectfully,  
McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant



EV333562072US ✓





PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(Case No. 99,818)

In re Application of: )  
Vogel, et. al. ) Group Art Unit: 2614  
Serial No.: 09/538,342 ) Examiner: Beliveau, Scott E.  
Filed: March 29, 2000 )  
For: Method For Improved Cable )  
Modem Ranging in a Data-Over- )  
Cable System )

Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

**TRANSMITTAL LETTER**

Dear Sir:

In regard to the above-identified patent application:

1. We are transmitting herewith the attached:
  - a. Amendment
  - b. Petition for Four Month Extension of Time
  - c. Return Receipt Postcard
2. Please charge \$1,450.00 to Deposit Account No. 13-2490.
3. Please charge any additional fees or credit overpayment to Deposit Account No. 13-2490.
4. **CERTIFICATE OF MAILING BY "EXPRESS MAIL" UNDER 37 CFR § 1.10:**  
The undersigned hereby certifies that this Transmittal Letter and the paper, as described hereinabove, are being deposited with the United States Postal Service with sufficient postage as "Express Mail Post Office to Addressee" being Express Mail No. EV333562072US in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450, on this 12th day of September, 2003.

Date: 9-12-03

By: 

Enrique Perez  
Reg. No. 43,853





PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(Case No. 99,818)

In re Application of:

Vogel, et. al.

Serial No. 09/538,342

Filed: March 29, 2000

For: Method For Improved Cable Modem  
Ranging in a Data-Over-Cable System

Examiner:  
M. Phan

Art Unit: 2664

**PETITION FOR FOUR MONTH EXTENSION OF TIME**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Sir:

Applicant hereby petition for a four-month extension of time in which to respond to the Office Action mailed on March 12, 2003. With this four-month extension, applicant's response is due by September 12, 2003. The requisite extension fee of \$1,450.00 accompanies this petition.

Respectfully submitted,

McDONNELL BOEHNEN  
HULBERT & BERGHOFF

Dated: September 12, 2003

  
Enrique Perez  
Reg. No. 43,853

McDONNELL BOEHNEN  
HULBERT & BERGHOFF  
300 South Wacker Drive  
Chicago, Illinois 60606  
(312) 913-0001





PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(MBHB Case No. 99,818)

In re Application of:

Mark O. Vogel

Serial No.: 09/538,342

Filed: March 29, 2000

For: **METHOD FOR IMPROVED CABLE  
MODEM RANGING IN A DATA-OVER-  
CABLE SYSTEM**

)  
) Group Art Unit: 2614  
)  
) Examiner: Beliveau, Scott E.  
)  
)  
)  
)  
)  
)  
)  
)  
)

**RESPONSE TO EX PARTE QUAYLE ACTION DATED MARCH 12, 2003**

Assistant Commissioner for Patents  
Washington, D.C. 20231

The Applicants respectfully request consideration of the following Amendments and Remarks in response to the Ex Parte Quayle Office Action mailed March 12, 2003.

**AMENDMENTS**

**In the Drawings:**

Amend Figure 10 by removing the reference numeral '218'.

**In the Specification:**

Amend page 9 second full paragraph starting at line 6 as follows:

In a typical two-way cable system, also termed a bi-directional cable system, a cable modem 28 will transmit data packets to the CMTS 30 over one or more upstream channels on the cable television network 22 and 26. In the upstream direction, data from the CPE 14 is transmitted from the cable modem 28 over the cable network 26 and 22 and received at a receiver module 42. The receiver module 42 couples the upstream signal to a splitter and filter bank 44



which separates the data signal from video signals for the cable television system and couples the data signal to a demodulation circuit 45 ("DEMOD") as in the CMTS 30. The data is processed by a network termination unit 46, sent to the switch or router 20 and routed onto the network 12 for transmission to the remote computer 10.

Amend page 7, last paragraph starting at line 17 as follows:

Background information related to cable modem systems in general is described in the Data-Over-Cable Service Interface Specifications ("DOCSIS") – Radio Frequency Interface Specifications, Interim Draft, dated July 24, 1998, issued by Cable Television Laboratories, Inc. ~~DOCSIS may be found today on the World Wide Web at the Universal Resource Locator ("URL") "www.cablemodem.com".~~ This document, known to persons working in the art, is incorporated by reference herein.

Amend page 11, last paragraph starting at line 19 and ending on page 12 as follows:

In one embodiment of the present invention, QAM-64 is used in the RF interface 52 for downstream transmission. In another embodiment of the present invention, QAM-16 or Quadrature Phase-Shift-Keying ("QPSK") is used for upstream transmission. For the upstream embodiment, the symbol rate of upstream transmission may be 160, 320, 640, 1,280, or 2,560 kilo-symbols per second ("ksym/sec") for 16-QAM, or 160, 320, 640, 1,280, or 2,560 ksym/sec for QPSK. However, other operating frequencies, modulation methods, and symbol rates may alternatively be used. Other information on the RF interface 52 can be found in the Institute of Electrical and Electronic Engineers ("IEEE") standard 802.14 for cable modems, which is incorporated herein by reference. ~~IEEE standards can be found today on the World Wide Web at the Universal Resource Locator ("URL") "www.ieee.org."~~ However, other RF interfaces 52 could also be used and the present invention is not limited to interfaces complying with IEEE 802.14.

Amend page 24 first paragraph starting at line 1 as follows:

When the Initial Maintenance interval occurs, the cable modem 28 sends a ranging request ("RNG-REQ") message



upstream to the CMTS 30. FIG. 7 is a block diagram illustrating a preferred structure of a RNG-REQ message 130. The Ranging Request message 130 includes a MAC 54 management header field 132, a service identifier field 76, a downstream channel identifier field 134[[120]], and a pending till complete field. Descriptions for the RNG-REQ message 130 fields are shown in Table 5.

Amend page 26 first full paragraph starting at line 3 as follows:

In response to receiving the RNG-REQ message 130 from the cable modem 28, the CMTS 30 transmits a Ranging Response ("RNG-RSP") message 140. FIG. 8 is a block diagram illustrating a preferred structure of a RNG-RSP message 140. The Ranging Response message 140 includes a MAC 54 management header field 142, a service identifier field 76, an upstream channel identifier field 144, and a TLV encoded ranging information field 146[[124]]. Descriptions for the RNG-RSP message 140 fields are shown in Table 6.



### **REMARKS**

In an ex parte Quayle action mailed on March 12, 2003, the Examiner requested that the following informalities be amended:

1. Drawings or specification to clarify references in drawings not mentioned in the specification: 45 (page 9, line 12) and 218;
2. Removal of hyperlinks on pages 7 and 12;
3. Correction of reference numbers used on pages 24 and 26.

Applicants have made the requested amendments and respectfully request passage to allowance.



**CONCLUSION**

Applicants therefore respectfully submit that all pending claims 1-32 are ready for allowance. If any questions or issues remain, the Examiner is invited to contact the undersigned attorney, Enrique Perez, at his direct dial number (312)

5 913-2104.

Respectfully submitted,

McDONNELL BOEHNEN  
HULBERT & BERGHOFF

Date: SEPTEMBER 12, 2003

By: 

Enrique Perez

Registration No. 43,583

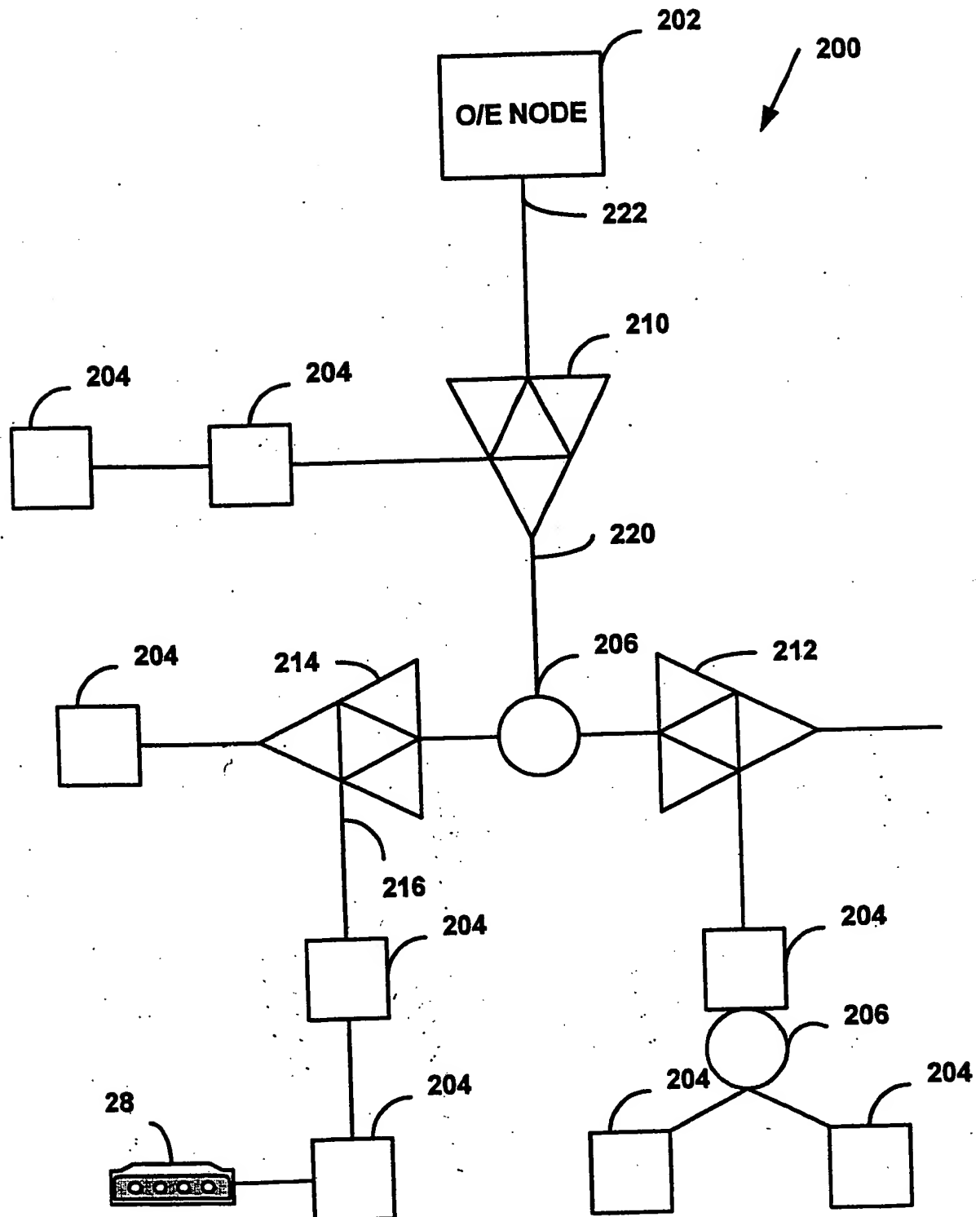


**APPENDIX A**

Appendix contains a Replacement Sheet and an Annotated Sheet Showing Changes.

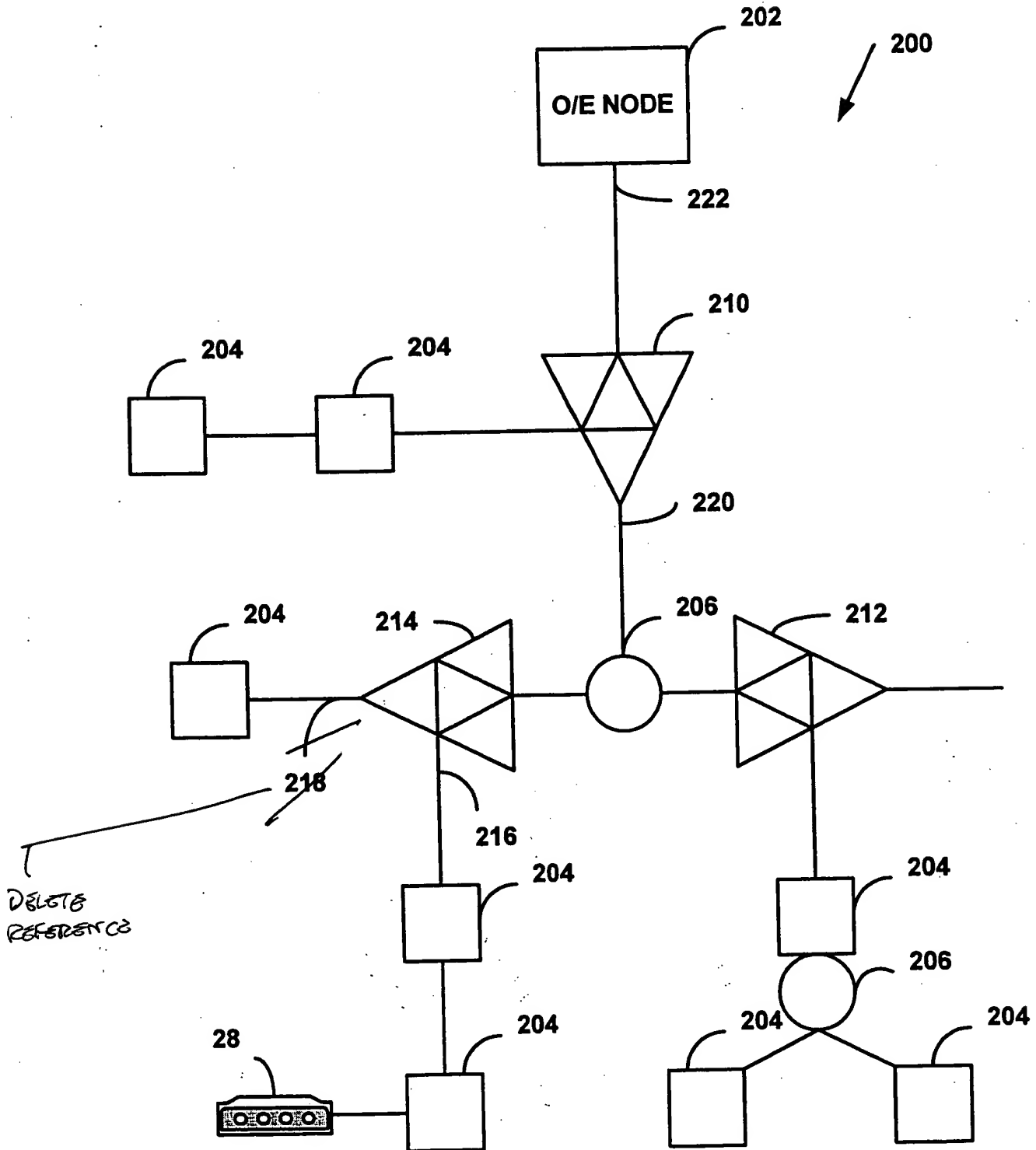


**FIG. 10**





**FIG. 10**





BEST AVAILABLE COPY

Hon. Commissioner of  
Patents and Trademarks

S/N

Atty EP

Re: Applicant - Vogel, et. al.

Case No. 99,818

Method for Improved Cable Modem Ranging in a Data-Over-Cable System

Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

- ☒ Transmittal Letter (in duplicate)
- ☒ Amendment
- ☒ Petition for Four Month Extension of Time

Fee Enclosed -- VIA DEPOSIT ACCOUNT

\$ 1,450.00

Date Mailed: September 12, 2003

Respectfully,  
McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant

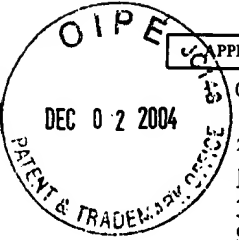
EV333562072US





UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov



APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

20306 7590 03/26/2003  
MCDONNELL BOEHNEN HULBERT & BERGHOFF  
300 SOUTH WACKER DRIVE  
SUITE 3200  
CHICAGO, IL 60606

EXAMINER

BELIVEAU, SCOTT E

ART UNIT	PAPER NUMBER
----------	--------------

2614

DATE MAILED: 03/26/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**DOCKETED**

APR 01 2003

DUE DATE:             
BY: RB CT



## **MISCELLANEOUS COMMUNICATION**

### ***Information Disclosure Statement***

The information disclosure statement (IDS) filed on 11 March 2003 was filed before the mailing date of the first Office Action on 12 March 2003. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered as indicated by the examiner.

The information presented therein does not materially impact the Ex Parte Quayle Action mailed on 12 March 2003.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott Beliveau whose telephone number is 703-305-4907.

The examiner can normally be reached on Monday-Friday from 8:00 a.m. - 5:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John W. Miller can be reached on 703-305-4795. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.



Application/Control Number: 09/538,342

Page 3

Art Unit: 2614

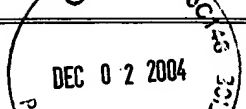
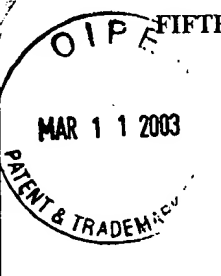
SEB

March 17, 2003



JOHN MILLER  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2600



M PTO-1449 ev. 2-32)		U.S. Department of Commerce Patent and Trademark Office		Atty. Docket No.  99,818	Serial No.  09/538,342
		FIFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use several sheets if necessary)		Applicant: Mark O. Vogel et al.	
Filing Date: March 29, 2000		Group: 2711			

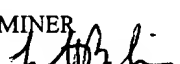
## U.S. PATENT

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
SEB	1.	6,510,162	01-21-03	Fijolek et al.	370	432	05-27-98
SEB	2.	5,929,850	07-27-99	Broadwin et al.	345	327	07-01-96
SEB	3.	5,528,595	06-18-96	Walsh et al.	370	85.13	11-14-95

RECEIVED

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc).

MAR 12 2003

SEB	4.	Droms, R., <i>Dynamic Host Configuration Protocol</i> , Request for Comments 1541, October 1993, Pages 1 to 31. <b>Technology Center 260X</b>
SEB	5.	RFC 791, <i>Internet Protocol</i> , <i>DARPA Internet Program Protocol Specification</i> , September 1981, Pgs. 1-37.
SEB	6.	Postel, J., <i>Internet Protocol</i> , <i>DARPA Internet Program Protocol Specification</i> , RFC 792, September 1981, Pgs. 1-14.
SEB	7.	Postel, J., <i>User Datagram Protocol</i> , RFC 768, August 28, 1980, Pgs. 1-3.
SEB	8.	RFC 793, <i>Transmission Control Protocol</i> , <i>DARPA Internet Program Protocol Specification</i> , September 1981, Pgs. 1-68.
SEB	9.	Case, J. et al., <i>A Simple Network Management Protocol (SNMP)</i> , RFC 1157, May 1990, Pgs. 1-26.
SEB	10.	Sollins, K., <i>The TFTP Protocol (Revision 2)</i> , RFC 1350, July 1992, Pgs. 1-9.
SEB	11.	Alexander, S., <i>DHCP Options and BOOTP Vendor Extensions</i> , RFC 2132, March 1997, Pgs. 1-37.
SEB	12.	"Radio Frequency Interface Specification (Interim Specification) SP-RF1v1.1-103-991105", MCNS Holdings, L.P., 1999, Pgs. ii to 366.
EXAMINER 		DATE CONSIDERED 3/17/03

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication.





## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

DEC 02 2004

## NOTICE OF ALLOWANCE AND FEE(S) DUE

20306 7590 10/20/2003  
MCDONNELL BOEHNEN HULBERT & BERGHOFF  
300 SOUTH WACKER DRIVE  
SUITE 3200  
CHICAGO, IL 60606

DOCKETED

OCT 24 2003

DUE DATE: 1/20/04  
BY: mo

EXAMINER

BELIVEAU, SCOTT E

ART UNIT

PAPER NUMBER

2614

DATE MAILED: 10/20/2003

15

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

TITLE OF INVENTION: METHOD FOR IMPROVED CABLE MODEM RANGING IN A DATA-OVER-CABLE SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1330	\$0	\$1330	01/20/2004

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN **THREE MONTHS** FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

## HOW TO REPLY TO THIS NOTICE:

## I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status is changed, pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above and notify the United States Patent and Trademark Office of the change in status, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check the box below and enclose the PUBLICATION FEE and 1/2 the ISSUE FEE shown above.

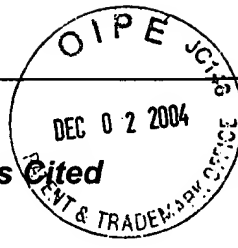
☐ Applicant claims SMALL ENTITY status.  
See 37 CFR 1.27.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER:** Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.



**Notice of References Cited**

Application/Control No.

09/538,342

Applicant(s)/Patent Under  
Reexamination  
VOGEL ET AL.

Examiner

Scott Beliveau

Art Unit

2614

Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,574,797	06-2003	Naegeli et al.	725/120
*	B	US-6,594,305	07-2003	Roeck et al.	375/222
*	C	US-6,594,467	07-2003	Asia et al.	455/3.03
*	D	US-6,111,887	08-2000	Daily et al.	370/449
*	E	US-6,445,930	09-2002	Bartelme et al.	455/522
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.





# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

20306 7590 10/20/2003

MCDONNELL BOEHNEN HULBERT & BERGHOFF  
300 SOUTH WACKER DRIVE  
SUITE 3200  
CHICAGO, IL 60606

**DOCKETED**

OCT 24 2003

DUE DATE: 10/20/2003  
BY: MB

EXAMINER

BELIVEAU, SCOTT E

ART UNIT PAPER NUMBER

2614

DATE MAILED: 10/20/2003

15

## Determination of Patent Term Extension under 35 U.S.C. 154 (b) (application filed after June 7, 1995 but prior to May 29, 2000)

The Patent Term Extension is 0 day(s). Any patent to issue from the above-identified application will include an indication of the 0 day extension on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Extension is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) system (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (703) 305-1383. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.



**Notice of Allowability**



Application No.

09/538,342

Examiner

Scott Beliveau

Applicant(s)

VOGEL ET AL.

Art Unit

2614

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 12 September 2003.
2. ☒ The allowed claim(s) is/are 1-32.
3. ☒ The drawings filed on 12 September 2003 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some\* c) ☐ None of the:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- \* Certified copies not received: \_\_\_\_\_.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
(a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS must be submitted.  
(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached  
1) ☐ hereto or 2) ☐ to Paper No. \_\_\_\_\_.  
(b) ☐ including changes required by the proposed drawing correction filed \_\_\_\_\_, which has been approved by the Examiner.  
(c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet.

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- 1 ☒ Notice of References Cited (PTO-892)  
3 ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
5 ☒ Information Disclosure Statements (PTO-1449), Paper No. 11.1.  
7 ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
- 2 ☐ Notice of Informal Patent Application (PTO-152)  
4 ☐ Interview Summary (PTO-413), Paper No. \_\_\_\_\_.  
6 ☐ Examiner's Amendment/Comment  
8 ☒ Examiner's Statement of Reasons for Allowance  
9 ☐ Other



## **DETAILED ACTION**

### ***Information Disclosure Statement***

1. The information disclosure statements (IDS) submitted on 24 March 2003 and 14 April 2003 were filed after the mailing date of the Ex Parte Quayle action on 12 March 2003. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### ***Drawings***

2. The replacement Figure 10 was received on 12 September. These drawings are approved.

### ***Allowable Subject Matter***

3. Claims 1-32 are allowed.
4. The following is an examiner's statement of reasons for allowance:

The art of record either alone or in combination does not teach or suggest the two aspects of the present invention such that the "cable modem begins ranging at the initial transmit level".

The first aspect, recited in claims 1, 16, and 28, describes a method for estimating an initial transmit level based on the comparison of a "characteristic value" transmitted to the cable modem and a "measured signal level of a downstream channel a the cable modem". The second aspect, recited in claims 10, 21, and 30, describes a method for adjusting an initial transmit level based on an implementation delta value.



As to the closest art of record, the DOCSIS “Radio Frequency Interface Specification (Interim Specification) SP-RFiv1.1-I06-001215” cited by the application, details the cable modem ranging process. The cable modem receives upstream transmission parameters and other configuration information via a Upstream Channel Descriptor (UDC) message (Section 7.2.2). The reference, however, does not suggest or disclose that this configuration information comprises a “characteristic value” for determining the initial transmit power level. Rather, standard discloses that the cable modem uses either a “minimum specified transmit power level” or one available from the cable modem non-volatile storage (Section 7.2.4.1) that is adjusted based on “delta” information transmitted from the CMTS (Section 6.3.2.5).

The Chiu et al. (US Pat no. 5,784,597) reference suggests that the cable modem initially transmits using an average power setting which is communicated by the headend (Col 26, Lines 9-26). While one of ordinary art might presume that this information may be transmitted as outlined in the DOCSIS standard via the UDC, the reference provides no further suggestion that the cable modem may utilize this information in conjunction with the “signal level of the downstream channel” so as to establish the “initial transmit level”.

The Palm (WO 00/67385) reference discloses a method wherein transmission parameter device communications initial power levels are determined and communicated to downstream devices including cable modems. This application claims priority to a number of US provisional applications that would qualify as prior art under 35 U.S.C 102 if published or patented. However, the cited reference does not qualify as prior art because it was not filed on or after 29 November 2000.



Art Unit: 2614

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### *Conclusion*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as follows.

- The Roeck et al. (US Pat No. 6,594,305) reference discloses a method and apparatus for rapidly determining whether a link in cable modem network is operational. The reference further discloses that the initial ranging power level may start from a minimum value unless a valid power is available from non-volatile storage.
- The Naegeli et al. (US Pat No. 6,574,797) reference discloses a method for transmitting data upstream to a headend by locating cleaner and more reliable data carriers.
- The Bartelme et al. (US Pat No. 6,445,930) reference discloses a method of determining power control parameters based on the received signal strength at the terminal unit.
- The Asia et al. (US Pat No. 6,594,467) reference discloses a system and method for remote maintenance and service that may change any operational parameters of one or more modems.



Art Unit: 2614

- The Daily et al. (US Pat No. 6,111,887) reference discloses a method and apparatus for power tuning a terminal of a bi-directional communications system.

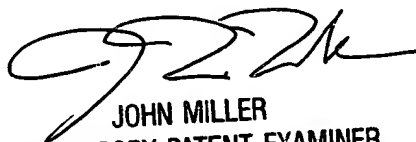
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott Beliveau whose telephone number is 703-305-4907.

The examiner can normally be reached on Monday-Friday from 8:00 a.m. - 5:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John W. Miller can be reached on 703-305-4795. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

SEB  
October 6, 2003

  
JOHN MILLER  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2600



## U.S. PATENT

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
SEB	1.	5,960,177	09-28-99	Tanno	395	200.59	03-12-96
SEB	2.	5,941,988	08-24-99	Bhagwat et al.	713	201	01-27-97
SEA	3.	6,289,377	09-11-01	Lalwaney et al.	709	222	10-27-98

**OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc).**

Technology Center 2600

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication.





# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188
20306	7590	10/20/2003		
MCDONNELL BOEHNEN HULBERT & BERGHOFF 300 SOUTH WACKER DRIVE SUITE 3200 CHICAGO, IL 60606				
			EXAMINER BELIVEAU, SCOTT E	
			ART UNIT 2614	PAPER NUMBER 15
DATE MAILED: 10/20/2003				

## Notice of Fee Increase on October 1, 2003

If a reply to a "Notice of Allowance and Fee(s) Due" is filed in the Office on or after October 1, 2003, then the amount due will be higher than that set forth in the "Notice of Allowance and Fee(s) Due" since there will be an increase in fees effective on October 1, 2003. See Revision of Patent Fees for Fiscal Year 2004; Final Rule, 68 Fed. Reg. 41532, 41533, 41534 (July 14, 2003).

The current fee schedule is accessible from (<http://www.uspto.gov/main/howtofees.htm>).

If the fee paid is the amount shown on the "Notice of Allowance and Fee(s) Due" but not the correct amount in view of the fee increase, a "Notice of Pay Balance of Issue Fee" will be mailed to applicant. In order to avoid processing delays associated with mailing of a "Notice of Pay Balance of Issue Fee," if the response to the Notice of Allowance is to be filed on or after October 1, 2003 (or mailed with a certificate of mailing on or after October 1, 2003), the issue fee paid should be the fee that is required at the time the fee is paid. If the issue fee was previously paid, and the response to the "Notice of Allowance and Fee(s) Due" includes a request to apply a previously-paid issue fee to the issue fee now due, then the difference between the issue fee amount at the time the response is filed and the previously-paid issue fee should be paid. See Manual of Patent Examining Procedure, Section 1308.01 (Eighth Edition, August 2001).

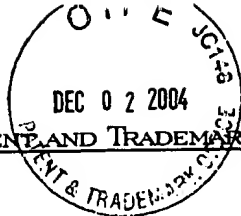
Effective October 1, 2003, 37 CFR 1.18 is amended by revising paragraphs (a) through (c) to read as set forth below.

### Section 1.18 Patent post allowance (including issue) fees.

- (a) Issue fee for issuing each original or reissue patent, except a design or plant patent:
- By a small entity (Sec. 1.27(a))..... \$665.00
  - By other than a small entity..... \$1,330.00
- (b) Issue fee for issuing a design patent:
- By a small entity (Sec. 1.27(a))..... \$240.00
  - By other than a small entity..... \$480.00
- (c) Issue fee for issuing a plant patent:
- By a small entity (Sec. 1.27(a))..... \$320.00
  - By other than a small entity..... \$640.00

Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.





UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/538,342	03/29/2000	Mark O. Vogel	99,818	6188

20306 7590 03/12/2003

MCDONNELL BOEHNEN HULBERT & BERGHOFF  
300 SOUTH WACKER DRIVE  
SUITE 3200  
CHICAGO, IL 60606

EXAMINER

BELIVEAU, SCOTT E

ART UNIT PAPER NUMBER

2614

DATE MAILED: 03/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

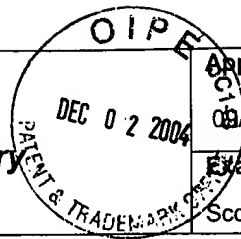
**DOCKETED**

MAR 18 2003

DUE DATE: 5/12/03

BY: KB CT



**Office Action Summary**

Application No.

09/538,342

Appl. i(s)

VOGEL ET AL.

Examiner

Scott Beliveau

Art Unit

2614

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☒ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-32 is/are allowed.
- 6) ☐ Claim(s) \_\_\_\_ is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3-7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: .



## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: 45 (Page 9, Line 12), 218. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### ***Specification***

2. The use of several trademarked corporate names have been noted in this application. It should be capitalized wherever it appears and be accompanied by the generic terminology if applicable. Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks.
3. The disclosure is objected to because it contains an embedded hyperlink and/or other form of browser-executable code (Page 7, Line 21; Page 12, Line 5). Applicant is required to delete the embedded hyperlink and/or other form of browser-executable code. See MPEP § 608.01.
4. The disclosure is objected to because of the following informalities:
  - Reference to the “downstream channel identifier field 120” should be amended to refer to the “downstream channel identifier field 134” (Page 24, Line 5);



Art Unit: 2614

- Reference to the “TLV encoded ranging information field 124” should be amended to refer to the “TLV encoded ranging information field 146” (Page 26, Line 7).

Appropriate correction is required.

***Allowable Subject Matter***

5. Claims 1-32 are allowed.
6. The following is an examiner’s statement of reasons for allowance:

The art of record either alone or in combination does not teach or suggest the two aspects of the present invention such that the “cable modem begins ranging at the initial transmit level”.

The first aspect, recited in claims 1, 16, and 28, describes a method for estimating an initial transmit level based on the comparison of a “characteristic value” transmitted to the cable modem and a “measured signal level of a downstream channel a the cable modem”. The second aspect, recited in claims 10, 21, and 30, describes a method for adjusting an initial transmit level based on an implementation delta value.

As to the closest art of record, the DOCSIS “Radio Frequency Interface Specification (Interim Specification) SP-RFIV1.1-I06-001215” cited by the application, details the cable modem ranging process. The cable modem receives upstream transmission parameters and other configuration information via a Upstream Channel Descriptor (UDC) message (Section 7.2.2). The reference, however, does not suggest or disclose that this configuration information comprises a “characteristic value” for determining the initial transmit power level. Rather, standard discloses that the cable modem uses either a “minimum specified



Art Unit: 2614

transmit power level” or one available from the cable modem non-volatile storage (Section 7.2.4.1) that is adjusted based on “delta” information transmitted from the CMTS (Section 6.3.2.5).

The Chiu et al. (US Pat no. 5,784,597) reference suggests that the cable modem initially transmits using an average power setting which is communicated by the headend (Col 26, Lines 9-26). While one of ordinary art might presume that this information may be transmitted as outlined in the DOCSIS standard via the UDC, the reference provides no further suggestion that the cable modem may utilize this information in conjunction with the “signal level of the downstream channel” so as to establish the “initial transmit level”.

The Palm (WO 00/67385) reference discloses a method wherein transmission parameter device communications initial power levels are determined and communicated to downstream devices including cable modems. This application claims priority to a number of US provisional applications that would qualify as prior art under 35 U.S.C 102 if patented. However, the cited reference does not qualify as prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as follows.



Art Unit: 2614

- The Chiu et al. (US Pat no. 5,784,597) reference discloses a method for initializing a cable modem such that the cable modem initially transmits using the average power setting as communicated by the headend (Col 26, Lines 9-26).
- The Palm (WO 00/67385) reference discloses an apparatus and method for determining transmission parameters while initializing a communication link.
- The Leano et al. (US Pat No. 6,453,472) reference discloses a method for performing periodic ranging of cable modems that includes the transmission of instructions for adjusting power levels.
- The Nazarathy et al. (US Pat No. 6,490,727) reference describes a hybrid fiber coaxial (HFC) network wherein a CMTS uses DOCSIS and DVB-RC standards to implement distributed calibration and synchronization techniques.
- The Burns et al. (US Pat No. 6,449,291) reference discloses a method and apparatus for time synchronization during the cable modem ranging process.
- The Grimwood et al. (US Pat No. 6,243,369) reference discloses a method and apparatus for synchronizing cable modems wherein an initial timing offset calculation is performed before starting the ranging process so as to reduce the number of iterations.

This application is in condition for allowance except for the following formal matters:

- Objections to Drawings;
- Objections to Specification.

Prosecution on the merits is closed in accordance with the practice under *Ex parte*

*Quayle*, 1935 C.D. 11, 453 O.G. 213.



Art Unit: 2614


A shortened statutory period for reply to this action is set to expire **TWO MONTHS** from the mailing date of this letter.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott Beliveau whose telephone number is 703-305-4907. The examiner can normally be reached on Monday-Friday from 8:00 a.m. - 5:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John W. Miller can be reached on 703-305-4795. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-0377.

SEB  
March 6, 2003

  
JOHN MILLER  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2600



<b>Notice of References Cited</b>	Application/Control No. 09/538,342	Applicant(s)/Patent Under Reexamination VOGEL ET AL.	
	Examiner Scott Beliveau	Art Unit 2614	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,784,597	07-1998	Chiu et al.	713/401
	B	US-6,243,369	06-2001	Grimwood et al.	370/335
	C	US-6,453,472	09-2002	Leano et al.	725/111
	D	US-6,449,291	09-2002	Burns et al.	370/516
	E	US-6,490,727	12-2002	Nazarathy et al.	725/129
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	WO 200067385 A1	11-2000	World Intellect	PALM, S	H04B 01/38
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



PTO-1449  
(rev. 2-32)

U.S. Department of Commerce  
Patent and Trademark Office

Atty. Docket No.

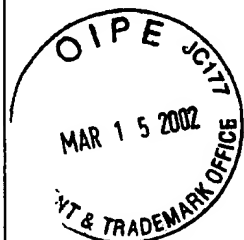
99,818

Serial No.

09/538,342

**SECOND SUPPLEMENTAL INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**

(Use several sheets if necessary)



**RECEIVED**

**MAR 19 2002**

Applicant:

Mark O. Vogel et al. **Technology Center 2600**

Filing Date:

March 29, 2000

Group:

2711

**U.S. PATENT DOCUMENTS**

Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
SEB	1	6,331,987	12-18-01	Beser	370	486	05-27-98
SEB	2	6,337,858	01-08-02	Petty et al.	370	356	10-10-97
SEB	3	5,926,458	07-20-99	Yin	370	230	01-31-97
SEB	4	6,046,979	04-04-00	Bauman	370	229	05-04-98
SEB	5	6,332,163	12-18-01	Bowman-Amuah	709	231	09-01-99

**OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc).**

SEB	6	"Radio Frequency Interface Specification (Interim Specification) SP-RFI-I04-980724", MCNS Holdings, L.P., 1997, Pgs. ii to 196.
EXAMINER <i>SEB</i>		DATE CONSIDERED <i>2/14/03</i>

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication.



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(Case No. 99,818)

In the Application of:	)	
	)	
Mark O. Vogel et al	)	
	)	Examiner: Not Assigned
Serial No.: 09/538,342	)	
	)	Group Art Unit: 2711
Filing Date: March 29, 2000	)	
	)	
For: Method for Improved Cable Modem	)	
Ranging in a Data-Over-Cable	)	
System	)	

**TRANSMITTAL LETTER**

Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

In regard to the above identified application,

1. We are transmitting herewith the attached:
  - a) Second Status Inquiry; and
  - b) Postcard.
2. With respect to fees:
  - a) No fee is required.
  - b) Please charge any underpayment or credit any overpayment our Deposit Account, No. 13-2490.
3. CERTIFICATE OF MAILING UNDER 37 CFR § 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described in paragraph 1, are being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents, Washington, D.C. 20231 on October 25, 2002.

Respectfully submitted,



Thomas E. Wettermann  
Registration No. 41,523



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(Case No. 99,818)

In the Application of:	)	
	)	
Mark O. Vogel et al	)	
	)	Examiner: Not Assigned
Serial No.: 09/538,342	)	
	)	Group Art Unit: 2711
Filing Date: March 29, 2000	)	
	)	
For: Method for Improved Cable Modem	)	
Ranging in a Data-Over-Cable	)	
System	)	

**TRANSMITTAL LETTER**


Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

In regard to the above identified application,

1. We are transmitting herewith the attached:
  - a) Second Status Inquiry; and
  - b) Postcard.
2. With respect to fees:
  - a) No fee is required.
  - b) Please charge any underpayment or credit any overpayment our Deposit Account, No. 13-2490.
3. CERTIFICATE OF MAILING UNDER 37 CFR § 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described in paragraph 1, are being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents, Washington, D.C. 20231 on October 25, 2002.

Respectfully submitted,

  
Thomas E. Wettermann  
Registration No. 41,523



Commissioner for Patents

S/N 09/538,342

Atty TEW

Re: Applicant – Mark O. Vogel, et al

Case No. 99,818

“Method for Improving Cable Modem Ranging in a Data-Over-Cable System”

Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

- (1) Transmittal Letter in duplicate;
- (2) Second Status Inquiry.

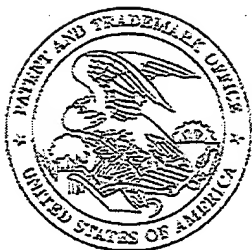
Fee Enclosed

\$ -0-

Date Mailed: October 25, 2002

Respectfully,  
McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant





## STATUS LETTER REPLY

99-818



UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office  
Washington, D.C. 20231

Serial Number: 09/538,342

Group Art Unit: 2711

Filing Date: 3/29/2000

Attorney Reference: 99,818

REQUESTER: Timothy Brumann

☒ Attorney of Record

- ☐ Not of Record. Therefore, the following status information is being released to the following ATTORNEY OF RECORD: \_\_\_\_\_
- ☐ Not of Record. Unfortunately, the status information can not be released because the requestor is not of record. If the requester should be of record, please forward additional changes to the Power of Attorney to the Customer Service Office.

### STATUS INFORMATION

☒ Action by the examiner  
Expected date for action on this application  
Month: 3 Year: '02

☐ Other (explain) \_\_\_\_\_

DOCKETED

AUG 20 2001

DUE DATE:

BY: mz/cb

E. Gary

Customer Service Office  
Technology Center 2600  
(703) 306-0377 (voice)  
(703) 872-9313 (fax)



Hon. Commissioner of Patents and Trademarks

S/N 09/538,342

Atty TRB/gs

Re: Applicant Vogel et al.

Case No.: 99,818

**Method For Improved Cable Modem Ranging In A Data-Over-Cable System**

Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

- (1) Transmittal Letter (in duplicate)
- (2) Status Inquiry



**Fee Enclosed**

**\$-0-**

Dated: July 20, 2001

Respectfully,

McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant

**BEST AVAILABLE COPY**



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
(MBHB Case No. 99,818)

In re Application of:	)	
	)	Group Art Unit: 2711
Vogel et al.	)	
	)	Examiner: To Be Assigned
Serial No. 09/538,342	)	
	)	
Filed: March 29, 2000	)	
	)	
For: Method For Improved Cable Modem Ranging	)	
In A Data-Over-Cable System	)	

**TRANSMITTAL LETTER**

Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

In regard to the above identified application,

1. We are transmitting herewith the attached:
  - a) Status Inquiry; and
  - b) Return Receipt Postcard.
  
2. With respect to fees:
  - a) No fee is required.
  - b) Please charge any underpayment or credit any overpayment our Deposit Account, No. 13-2490.
  
3. CERTIFICATE OF MAILING UNDER 37 CFR § 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described in paragraph 1, are being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Commissioner for Patents, Washington, D.C. 20231 on July 20, 2001.

Respectfully submitted,



Timothy R. Baumann  
Registration No. 40,502



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(MBHB Case No. 99,818)

In re Application of:	)	
	)	Group Art Unit: 2711
Vogel et al.	)	
	)	Examiner: To Be Assigned
Serial No. 09/538,342	)	
	)	
Filed: March 29, 2000	)	
	)	
For: Method For Improved Cable Modem Ranging	)	
In A Data-Over-Cable System	)	

STATUS INQUIRY

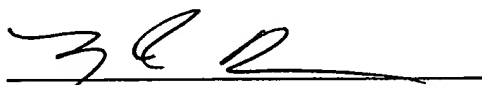
Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Applicants respectfully request an indication of the status of the above-referenced application. This application was filed on March 29, 2000. However, to date, the Applicants have not received an office action. Applicants would gratefully appreciate receiving a written communication indicating when Applicants may expect to receive a first office action on this application.

Respectfully submitted,

Date: July 20, 2001

  
Timothy R. Baumann  
Registration No. 40,502



BEST AVAILABLE COPY

Hon. Commissioner of  
Patents and Trademarks

S/N

Atty MJD

Re: Applicant - Mark O. Vogel et al.

Case No. 99,818

Method for Improved Cable Modem Ranging in a Data-Over-Cable System

Sir:

Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

- ☒ Utility Patent Application Transmittal in Duplicate
- ☒ Specification (51 sheets including claims)
- ☒ Drawings (11 sheets)
- ☒ Signed Declaration and Power of Attorney
- ☒ Filing Fee Check
- ☒ Assignment Recordal Cover Sheet and Assignment
- ☒ Other Certificate of Express Mail

EL028733964US

Fee Enclosed

1c542 U.S. PTO  
09/538342

Express Mail No. EL028733964US

\$ 1,180.00

Date Mailed: March 29, 2000



03/29/00

Respectfully,  
McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant



# UTILITY PATENT APPLICATION TRANSMITTAL

*Submit an original and a duplicate for fee processing  
(Only for new nonprovisional applications under 37 CFR 1.53(b))*

<b>ADDRESS TO:</b>  <b>Assistant Commissioner for Patents</b> <b>Box Patent Application</b> <b>Washington, D.C. 20231</b>	<table style="width: 100%; border: none;"> <tr> <td style="border: none;">Attorney Docket No.</td> <td style="border: none;">99,818</td> </tr> <tr> <td style="border: none;">First Named Inventor</td> <td style="border: none;">Mark O. Vogel</td> </tr> <tr> <td style="border: none;">Express Mail No.</td> <td style="border: none;">EL028733964US</td> </tr> <tr> <td style="border: none;">Total Pages</td> <td style="border: none;">74</td> </tr> </table>	Attorney Docket No.	99,818	First Named Inventor	Mark O. Vogel	Express Mail No.	EL028733964US	Total Pages	74
Attorney Docket No.	99,818								
First Named Inventor	Mark O. Vogel								
Express Mail No.	EL028733964US								
Total Pages	74								

APPLICATION ELEMENTS	ACCOMPANYING APPLICATION PARTS
<ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> Transmittal Form with Fee</li> <li>2. <input checked="" type="checkbox"/> Specification (including claims and abstract) [Total Pages 51]</li> <li>3. <input checked="" type="checkbox"/> Drawings [Total Sheets 11]</li> <li>4. <input checked="" type="checkbox"/> Oath or Declaration [Total Pages 3]                             <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> Newly executed</li> <li>b. <input type="checkbox"/> Copy from prior application</li> </ol> <p style="margin-left: 40px;"><b>[Note Boxes 5 and 17 below]</b></p> <ol style="list-style-type: none"> <li>i. <input type="checkbox"/> <u>Deletion of Inventor(s)</u> Signed statement attached deleting inventor(s) named in the prior application</li> </ol> </li> <li>5. <input type="checkbox"/> Incorporation by Reference: The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.</li> <li>6. <input type="checkbox"/> Microfiche Computer Program</li> <li>7. <input type="checkbox"/> Nucleotide and/or Amino Acid Sequence Submission                             <ol style="list-style-type: none"> <li>a. <input type="checkbox"/> Computer Readable Copy</li> <li>b. <input type="checkbox"/> Paper Copy</li> <li>c. <input type="checkbox"/> Statement verifying above copies</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>8. <input checked="" type="checkbox"/> Assignment Papers</li> <li>9. <input checked="" type="checkbox"/> Power of Attorney</li> <li>10. <input type="checkbox"/> English Translation Document (if applicable)</li> <li>11. <input type="checkbox"/> Information Disclosure Statement (IDS)                             <div style="margin-left: 20px;"> <input type="checkbox"/> PTO-1449 Form  <input type="checkbox"/> Copies of IDS Citations                             </div> </li> <li>12. <input type="checkbox"/> Preliminary Amendment</li> <li>13. <input checked="" type="checkbox"/> Return Receipt Postcard (Should be specifically itemized)</li> <li>14. <input type="checkbox"/> Small Entity Statement(s)                             <div style="margin-left: 20px;"> <input type="checkbox"/> Enclosed  <input type="checkbox"/> Statement filed in prior application; status still proper and desired                             </div> </li> <li>15. <input type="checkbox"/> Certified Copy of Priority Document(s)</li> <li>16. <input checked="" type="checkbox"/> Other: Certificate of Express Mail</li> </ol>
<b>17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:</b> <input type="checkbox"/> Continuation <input type="checkbox"/> Divisional <input type="checkbox"/> Continuation-in-part of prior application Serial No.	

APPLICATION FEES				
BASIC FEE				\$690.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total Claims	32 -20=	12	x \$18.00	\$216.00
Independent Claims	6 - 3=	3	x \$78.00	\$234.00
<input type="checkbox"/> Multiple Dependent Claims(s) if applicable				+\$270.00
Total of above calculations =				\$1,140.00
Reduction by 50% for filing by small entity =				\$( )
<input checked="" type="checkbox"/> Assignment fee if applicable				+ \$40.00
TOTAL =				\$1,180.00



## UTILITY PATENT APPLICATION TRANSMITTAL

Attorney Docket No. 99,818

18. ☐ Please charge my Deposit Account No. 13-2490 in the amount of \$ .
19. ☒ A check in the amount of \$1,180.00 is enclosed.
20. The Commissioner is hereby authorized to credit overpayments or charge any additional fees of the following types to Deposit Account No. 13-2490:
- a. ☒ Fees required under 37 CFR 1.16.
  - b. ☒ Fees required under 37 CFR 1.17.
  - c. ☐ Fees required under 37 CFR 1.18.
21. ☐ The Commissioner is hereby generally authorized under 37 CFR 1.136(a)(3) to treat any future reply in this or any related application filed pursuant to 37 CFR 1.53 requiring an extension of time as incorporating a request therefor, and the Commissioner is hereby specifically authorized to charge Deposit Account No. 13-2490 for any fee that may be due in connection with such a request for an extension of time.

## 22. CORRESPONDENCE ADDRESS

Name	McDonnell Boehnen Hulbert & Berghoff
Address	32 <sup>nd</sup> Floor, 300 South Wacker Drive
City, State, Zip	Chicago, Illinois 60606

## 23. SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Name	Lawrence H. Aaronson , Reg. No. 35,818
Signature	<i>Lawrence H. Aaronson</i>
Date	March 29, 2000

UTILITY (Rev. 11/18/97)



# RECORDATION FORM COVER SHEET PATENTS ONLY

To The Honorable Commissioner of Patents and Trademarks: Please record the attached original documents or copy thereof.

<p>1. Name of conveying party(ies):</p> <p>Mark O. Vogel Philip Robinson</p> <p>Additional name(s) of conveying party(ies) attached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p>	<p>2. Name and address of receiving party(ies)</p> <p>Name: 3Com Corporation</p> <p>Address: 5400 Bayfront Plaza</p> <p>City: Santa Clara State: California</p> <p>Country: U.S.A. Zip: 95052</p> <p>Additional name(s) &amp; address(es) attached? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p>
<p>3. Nature of conveyance:</p> <p><input checked="" type="checkbox"/> Assignment <input type="checkbox"/> Merger</p> <p><input type="checkbox"/> Security Agreement <input type="checkbox"/> Change of Name</p> <p><input type="checkbox"/> Other _____</p> <p>Execution Date: March 23, 2000 and March 27, 2000</p>	

4. Application number(s) or patent number(s):

If this document is being filed together with a new application, the execution date of the application is: March 23, 2000

A. Patent Application No.(s)	B. Patent No.(s)

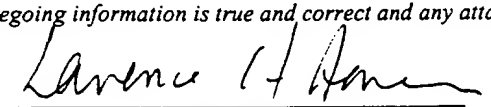
Additional numbers attached? ☐ Yes ☒ No

<p>5. Name and address of party to whom correspondence concerning document should be mailed:</p> <p>Name: Lawrence H. Aaronson</p> <p>Registration No.: 35,818</p> <p>Company Name: McDonnell, Boehnen, Hulbert &amp; Berghoff</p> <p>Street Address: 300 South Wacker Drive – 32<sup>nd</sup> Floor</p> <p>City: Chicago State: Illinois</p> <p>Country: U.S.A. ZIP: 60606</p>	<p>6. Total number of applications and patents involved: 1</p> <p>7. Total Fee (37 CFR 3.41).....\$40.00</p> <p><input checked="" type="checkbox"/> Enclosed</p> <p><input type="checkbox"/> Authorized to be charged to deposit account</p> <p>8. Deposit account number:</p> <p>13-2490</p>
---	---

DO NOT USE THIS SPACE

9. Statement and signature.

*To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.*

Lawrence H. Aaronson  Date: March 29, 2000

Printed Name of Person Signing Signature

Total number of pages including cover sheet, attachments, and document: 3

Mail documents to be recorded with required cover sheet information to:

Commissioner of Patents and Trademarks  
Box Assignments  
Washington, D.C. 20231



## ASSIGNMENT

Case No.: 99,818  
Inventors: Mark O. Vogel and Philip Robinson  
Date of Execution  
of Application:

Serial No.:

Filing Date:

In consideration of One Dollar (\$1.00) and other good and valuable considerations in hand paid, the receipt and sufficiency whereof are hereby acknowledged, the undersigned hereby assign to:

**3Com Corporation, a corporation of the State of Delaware**

its successors and assigns, the entire right, title and interest in the invention or improvements of the undersigned disclosed in an application for Letters Patent of the United States, entitled:

**Method for Improved Cable Modem Ranging in a Data-Over-Cable System**

and identified as:

**Case No. 99,818**

in the offices of McDONNELL BOEHNEN HULBERT & BERGHOFF and in said application and any and all other applications, both United States and foreign, which the undersigned may file, either solely or jointly with others, on said invention or improvements, and in any and all Letters Patent of the United States and foreign countries, which may be obtained on any of said applications, and in any reissue or extension of such patents, and further assigns to said assignee the priority right provided by the International Convention.

The undersigned hereby authorize and request the Commissioner of Patents and Trademarks to issue said Letters Patent to said assignee.

The undersigned hereby authorize and request the attorneys of record in said application to insert in this assignment the filing date and serial number of said application when officially known, and the date of execution of the application.

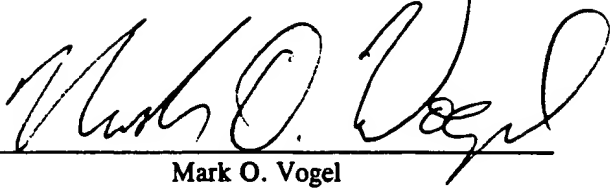
The undersigned warrant themselves to be the owners of the entire right, title and interest in said invention or improvements and to have the right to make this assignment, and further warrant that there are no outstanding prior assignments, licenses, or other encumbrances on the interest herein assigned.

For said considerations the undersigned hereby agree, upon the request and at the expense of said assignee, its successors and assigns, to execute any and all divisional, continuation and substitute applications for said invention or improvements, and any necessary oath, affidavit or declaration relating thereto, and any application for the reissue or extension of any Letters Patent that may be granted upon said application and any and all applications and other documents for Letters Patent in foreign countries on said invention or improvements, that said assignee, its successors or assigns may deem necessary or expedient, and for the said considerations the undersigned authorize said assignee to apply for patents for said invention or improvements in its own name in such countries where such procedure is proper and further agree, upon the request of said assignee, its successors and assigns, to cooperate to the best of the ability of the undersigned with said assignee, its successors and assigns, in any proceedings or transactions involving such applications or patents, including the preparation and execution of preliminary statements, giving and producing evidence, and performing any and all other acts necessary to obtain, maintain and enforce said Letters Patent, both United States and foreign, and vest all rights therein hereby conveyed in the assignee, its successors and assigns, whereby said Letters Patent will be held and enjoyed by the said assignee, its successors and assigns, to the full end of the term for which said Letters Patent will be granted,



as fully and entirely as the same would have been held and enjoyed by the undersigned if this assignment had not been made.

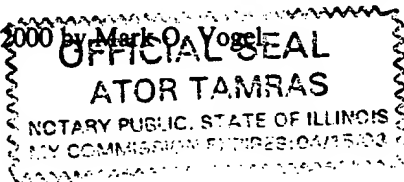
WITNESS my hand and seal this 27 day of March, 2000.

  
Mark O. Vogel

State of Illinois

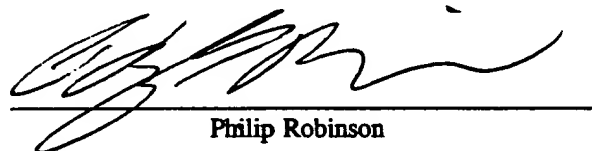
County of Cook

The foregoing instrument was acknowledged before me this 27<sup>th</sup> day of  
March, 2000 by Mark O. Vogel



  
NOTARY PUBLIC

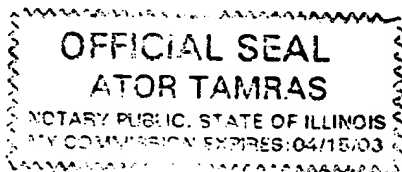
WITNESS my hand and seal this 23 day of March, 2000.

  
Philip Robinson

State of Illinois

County of Cook

The foregoing instrument was acknowledged before me this 23<sup>rd</sup> day of  
March, 2000 by Philip Robinson.



  
NOTARY PUBLIC



# DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

## Method for Improved Cable Modem Ranging in a Data-Over-Cable System

the specification of which is attached hereto unless the following space is checked:

☐ was filed on \_\_\_\_\_ as United States Application Serial Number \_\_\_\_\_

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s):

	<u>Number</u>	<u>Country</u>	<u>Day/Month/Year Filed</u>
1.			
2.			

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

	<u>Application Number</u>	<u>Filing Date</u>
1.		
2.		

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

	<u>Application Number</u>	<u>Filing Date</u>	<u>Status: patented, pending, abandoned</u>
1.			
2.			



I hereby appoint the following attorneys and agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

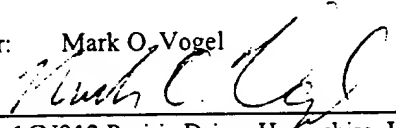
Denis A. Berntsen	Reg. No. 26707	George I. Lee	Reg. No. 39269
John J. McDonnell	Reg. No. 26949	James M. McCarthy	Reg. No. 39296
Daniel A. Boehnen	Reg. No. 28399	Monica Grewal	Reg. No. 40056
Bradley J. Hulbert	Reg. No. 30130	Jeremy Noe (agent)	Reg. No. 40104
Paul H. Berghoff	Reg. No. 30243	Sean M. Sullivan	Reg. No. 40191
Grantland G. Drutchas	Reg. No. 32565	Timothy R. Baumann	Reg. No. 40502
Steven J. Sarussi	Reg. No. 32784	Amir N. Penn	Reg. No. 40767
David M. Frischkorn	Reg. No. 32833	Patrick J. Halloran	Reg. No. 41053
James C. Gumina	Reg. No. 32898	Joshua R. Rich	Reg. No. 41269
A. Blair Hughes	Reg. No. 32901	Thomas E. Wettermann	Reg. No. 41523
Thomas A. Fairhall	Reg. No. 34591	Vernon W. Francissen	Reg. No. 41762
Emily Miao	Reg. No. 35285	Robert J. Irvine	Reg. No. 41865
Kevin E. Noonan	Reg. No. 35303	Richard A. Machonkin	Reg. No. 41962
Leif R. Sigmond, Jr.	Reg. No. 35680	David S. Harper	Reg. No. 42636
Lawrence H. Aaronson	Reg. No. 35818	Stephen Lesavich	Reg. No. 43749
Matthew J. Sampson	Reg. No. 35999	Enrique Perez	Reg. No. 43853
Curt J. Whitenack	Reg. No. 36054	Marcus J. Thymian	Reg. No. 43954
Christopher M. Cavan	Reg. No. 36475	S. Richard Carden	Reg. No. 44588
Michael S. Greenfield	Reg. No. 37142	Mark L. Chael (agent)	Reg. No. 44601
Roger P. Zimmerman	Reg. No. 38670	Stephen H. Docter	Reg. No. 44659
Anthoula Pomrening	Reg. No. 38805		

Address all telephone calls to Lawrence H. Aaronson at (312) 913-0001.

Address all correspondence to MCDONNELL BOEHNEN HULBERT & BERGHOFF, 300 South Wacker Drive, Chicago, Illinois 60606 USA.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: Mark O. Vogel

Inventor's signature: 

Date: 3/23/00

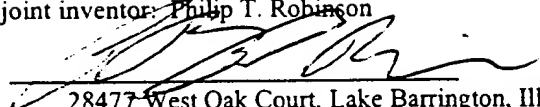
Residence: 16N912 Prairie Drive, Hampshire, Illinois 60140, U.S.A.

Citizenship: U.S.A.

Post Office Address: 16N912 Prairie Drive, Hampshire, Illinois 60140, U.S.A.



Full name of second joint inventor: Philip T. Robinson

Inventor's signature: 

Date: 3/23/00

Residence:

28477 West Oak Court, Lake Barrington, Illinois 60010, U.S.A.

Citizenship:

U.S.A.

Post Office Address:

28477 West Oak Court, Lake Barrington, Illinois 60010, U.S.A.



**APPLICATION FOR A UNITED STATES PATENT**  
**UNITED STATES PATENT AND TRADEMARK OFFICE**  
(CASE No. 99,818)

Title:       **METHOD FOR IMPROVED CABLE MODEM RANGING IN A DATA-  
OVER-CABLE SYSTEM**

5   Inventor:   Mark O. Vogel, a citizen of the United States of America, and a resident of  
Hampshire, Illinois; and

Philip Robinson, a citizen of the United States of America, and a resident of  
Barrington, Illinois

10

15   Assignee:   3Com Corporation  
5400 Bayfront Plaza  
Santa Clara, CA 95052



## FIELD OF INVENTION

The present invention relates to communications over a network. More specifically, it relates to a method for improving cable modem ranging in an initial maintenance region in a data-over-cable system.

5

## BACKGROUND OF THE INVENTION

With the explosive growth of the Internet, many customers have desired to use the larger bandwidth of a cable television network to connect to the Internet and other computer networks. Cable modems, such as those provided by 3Com Corporation of Santa Clara, California, and others offer customers higher-speed connectivity to the Internet, an intranet, local area networks ("LANs") and other computer networks via cable television networks. These cable modems currently support a data connection to the Internet and other computer networks via a cable television network with a data rate of up to 30+ Mbps which is a much larger data rate than can be supported by a modem used over a standard telephone line.

15 When a cable modem is connected to a data-over-cable system, it must first gain access to the system by undergoing an initialization procedure before it is permitted to transmit data. A part of the initialization procedure includes a ranging process to determine the appropriate transmission parameters for its data transfer. This process involves sending a ranging message at an appropriate time interval, referred to as initial maintenance interval. Because the cable  
20 modem does not know beforehand the loss between it and a cable modem termination system ("CMTS"), the cable modem initially transmits at a minimum specified level and then increases the level throughout the ranging process. The ranging process is performed so that the cable modem does not transmit at levels that can overdrive station equipment and cause impairments to



other channels. After transmitting the ranging message, the cable modem awaits an acknowledgement from the CMTS. If the cable modem receives no acknowledgement from the CMTS, the cable modem raises its power level and transmits a ranging message again. This process is repeated until the modem receives an acknowledgement from the CMTS, at which  
5 time the cable modem moves into the next phase of ranging, known as station maintenance.

A typical cable modem, however, has no prior network knowledge of the data-over-cable system when the initial ranging process is performed. The cable modem is, therefore, typically unable to select the proper transmit level on the first attempt. It may in fact take many attempts to select the proper transmit level if the required transmit level is sufficiently high or the  
10 increments for increasing the power level are small. In addition, since initial maintenance intervals are contention regions, i.e. multiple modems can attempt ranging within the interval, cable modem ranging messages may collide and be ignored by the CMTS, resulting in multiple attempts at transmission at a given power level before the CMTS receives a ranging message. These factors can lead to long ranging times, especially when there are many cable modems  
15 attempting to range.

It is, therefore, desirable to improve the ranging phase of a cable modem, by reducing the time for the cable modem to range.



## SUMMARY OF THE INVENTION

One aspect of the invention is a method for estimating an initial transmit level for a cable modem to range on an upstream channel of a data-over-cable system. The upstream channel carries data transmissions from a plurality of cable modems to a cable modem termination system. The method includes ascertaining a characteristic value for the data-over-cable system. The characteristic value is associated with configuration parameters for the data-over-cable system. A signal level of a downstream channel is measured on the cable modem. The downstream channel carries data transmissions from the cable modem termination system to the plurality of cable modems. The initial transmit level is set to a difference between the characteristic value and the signal level of the downstream channel.

Another aspect of the invention is a method for adjusting an initial transmit level for a cable modem to range on an upstream channel. The method includes receiving an implementation delta value on the cable modem in a message from a cable modem termination system. The implementation delta value represents a dynamic correction to the initial transmit level, the delta value being responsive to changes in the data-over-cable network. The initial transmit level is adjusted by adding the implementation delta value to the initial transmit level.



## BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of preferred embodiments of the present invention will be more readily apparent from the following detailed description, which proceeds with references to the accompanying drawings:

5        FIG. 1 is a block diagram illustrating a basic architecture for a data-over-cable system;

FIG. 2 is a block diagram illustrating a protocol stack for a cable modem in the cable modem system depicted in FIGURE 1;

FIG. 3 is a block diagram illustrating a structure of a Request message that may be transmitted by a cable modem in the cable modem system of FIGURE 1;

10       FIG. 4 is a block diagram illustrating the structure of a MAP message transmitted by a CMTS in the cable modem system of FIGURE 1;

FIG. 5 is a block diagram illustrating the structure of MAP Information Elements that may appear in the MAP message of FIGURE 4;

15       FIG. 6 is a block diagram illustrating the structure of a UCD message transmitted by a CMTS in the cable modem system of FIGURE 1;

FIG. 7 is a block diagram illustrating the structure of a RNG-REQ message that may be transmitted by a cable modem in the cable modem system of FIGURE 1;

FIG. 8 is a block diagram illustrating the structure of a RNG-RSP message transmitted by a CMTS in the cable modem system of FIGURE 1;

20       FIG. 9 is a block diagram illustrating a typical message flow during CM initialization in the cable modem system depicted in FIGURE 1;

FIG. 10 is a block diagram illustrating a configuration of Hybrid Fiber/Coaxial network;



FIG. 11 is a flow diagram illustrating a method for estimating an initial transmit level;

and

FIG. 12 is a flow diagram illustrating a method for adjusting an initial transmit level.



## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Cable television networks such as those provided by Comcast Cable Communications, Inc., of Philadelphia, Pennsylvania, Cox Communications of Atlanta, Georgia, Tele-Communications, Inc., of Englewood, Colorado, Time-Warner Cable, of Marietta, Georgia,  
5 Continental Cablevision, Inc., of Boston, Massachusetts, and others provide cable television service to a large number of subscribers over a large geographical area. The cable television networks typically are interconnected by cables such as coaxial cables or a Hybrid Fiber/Coaxial ("HFC") cable system. The system can also provide data services having data rates from about 10 Mega-bits-per-second ("Mbps") to 30+ Mbps per channel.

10 The Internet, a world wide network of interconnected computers, provides multi-media content including audio, video, graphics and text that may be best experienced, whether viewing or downloading, using a large bandwidth. Most Internet Service Providers ("ISPs") allow customers to connect to the Internet via a serial telephone line from a public switched telephone network at data rates including 14,400 bps, 28,800 bps, 33,600 bps, 56,000 bps and others that  
15 are much slower than the about 10 Mbps to 30+ Mbps available on a coaxial cable or HFC cable system on a cable television network.

Background information related to cable modem systems in general is described in the Data-Over-Cable Service Interface Specifications ("DOCSIS") – Radio Frequency Interface Specifications, Interim Draft, dated July 24, 1998, issued by Cable Television Laboratories, Inc.  
20 DOCSIS may be found today on the World Wide Web at the Universal Resource Locator ("URL") "www.cablemodem.com". This document, known to persons working in the art, is incorporated by reference herein.



The basic overall architecture of a data-over-cable system is shown in FIG. 1. The system of FIG. 1 provides a mechanism by which a computer 10 connected, either directly or indirectly by intermediate networks, to a backbone network 12, may communicate with another computer 14 via a data-over-cable infrastructure indicated generally by reference numeral 16.

5 The cable television infrastructure 16 includes a distribution hub or "head-end" 18 that is connected to the backbone network 12 via a switch or router 20. A cable system head-end 18 is a central location in the cable television network that is responsible for sending cable signals in the downstream direction as defined below. The head-end 18 modulates digital data from the backbone network 12 into analog form and supplies the analog signals to a fiber network 22,

10 which is connected to a plurality of optical/electronic ("O/E") nodes 24. The O/E nodes 24 convert optical signals in the fiber network 22 to electrical signals for transmission over a coax cable network 26 to a cable modem 28 at the customer's location. The cable modem ("CM") 28 demodulates the analog signals, extracts the digital data, and supplies the data to the customer premise equipment ("CPE") 14, which, in a typical situation, is a general purpose computer in a

15 home environment but may alternatively be a multimedia display device or a point-of-sale terminal in a store.

The head-end 18 includes a cable modem termination system ("CMTS") 30. This device provides a network side interface to a wide area network, indicated at 32, and a radio frequency ("RF") interface between the CMTS 30 and the cable network in both the downstream and

20 upstream directions, indicated respectively at 34 and 36. The term "downstream", as used in the present document, refers to transmission in the direction from the head-end 18 or CMTS 30 to the cable modem 28 at the customer premises. The term "upstream" refers to transmission in the direction from the cable modem 28 at the customer premises to the CMTS 30.



For transmission in the downstream direction, the CMTS 30 supplies data received from the computer 10 through the network 12 to a modulation circuit ("MOD") 37 and then to a combiner 38, where the data is combined with video signals for the cable television system. The combined signals are sent to a transmission module 40 where they are imparted onto the fiber network 22.

In a typical two-way cable system, also termed a bi-directional cable system, a cable modem 28 will transmit data packets to the CMTS 30 over one or more upstream channels on the cable television network 22 and 26. In the upstream direction, data from the CPE 14 is transmitted from the cable modem 28 over the cable network 26 and 22 and received at a receiver module 42. The receiver module 42 couples the upstream signal to a splitter and filter bank 44 which separates the data signal from video signals for the cable television system and couples the data signal to a demodulation circuit ("DEMOM") as in the CMTS 30. The data is processed by a network termination unit 46, sent to the switch or router 20 and routed onto the network 12 for transmission to the remote computer 10.

A data packet may carry, as its payload, information that is sent from the CPE 14 and destined for the CMTS 30. The cable modem 28 adds overhead to the data packet to maintain the integrity of the payload. Examples of overhead include redundant bits for error correction and preambles. On the cable network 22 and 26 side of the cable modem 28, the data packet and overhead are transmitted from and received by the cable modem 28 in the form of digitally modulated radio frequency carriers. An exemplary bi-directional data-over-cable system includes customer premises equipment 14 (e.g., a customer computer), a cable modem 28, a CMTS 30, a cable television network 18, 22, 26, and a backbone data network 12 (e.g., the Internet).



However, some cable television networks provide only uni-directional cable systems, supporting only the “downstream” cable data path. A return data path via a telephone network, which may be referred to as a “telephony return”, such as a public switched telephone network provided by AT&T, GTE, Sprint, MCI and others, may be used for the “upstream” data path. A cable television system with an upstream connection to a telephony network may be referred to as a “data-over-cable system with telephony return.” Such a return system is indicated in FIG. 1 where the cable modem 28 is also shown connected to the public switched telephone network (“PSTN”) 48 which is in turn connected to the backbone network 12 as indicated by the dashed line. An exemplary data-over-cable system with telephony return includes customer premises equipment 14, a cable modem 28, a CMTS 30, a cable television network 18, 22, 26, a public switched telephone network 48, a telephony remote access concentrator (“TRAC”) 49 and a backbone data network 12. The CMTS 30 and the telephony remote access concentrator 49 together may be referred to as a “telephony return termination system.”

The preferred embodiments may be utilized with either a bi-directional cable system or a data-over-cable system with telephony return. Cable modems and cable modem termination systems include those provided by 3Com Corporation of Santa Clara, California, Motorola Corporation of Schaumburg, Illinois, Hewlett-Packard Co. of Palo Alto, California, Bay Networks of Santa Clara, California, Scientific-Atlanta of Norcross, Georgia, General Instruments of Horsham, Pennsylvania, and others.

## **Cable modem protocol stack**

FIG. 2 is a block diagram illustrating a protocol stack 50 for the cable modem 28. FIG. 2 illustrates the downstream and upstream protocols used in the cable modem 28. As is known in the art, the Open System Interconnection (“OSI”) model is used to describe computer networks.



The OSI model consists of seven layers including from lowest-to-highest, a physical, data-link, network, transport, session, presentation and application layer. The network layer places routing information into the data packets. The data link layer transmits data packets. The physical layer transmits the data packets and overhead as bits over a communication link.

5           For data transmission over a bi-directional data-over-cable system, the cable modem 28 is connected to the cable network 26 in a physical layer via a radio frequency ("RF") interface 52. In an exemplary preferred embodiment of the present invention, the RF interface 52 has an operation frequency range of approximately 50 Mega-Hertz ("MHz") to 1 Giga-Hertz ("GHz") and a channel bandwidth of 6 MHz on the downstream channels. In another exemplary preferred  
10           embodiment of the present invention, which relates to a bi-directional data-over-cable system, the RF interface 52 has an operation frequency range of approximately 5 MHz to 42 MHz on the upstream channels. However, other operation frequencies and bandwidths may also be used and the invention is not limited to these frequencies and bandwidths. The RF interface 52 preferably uses a signal modulation method of Quadrature Amplitude Modulation ("QAM"). As is known  
15           in the art, QAM is used as a means of encoding digital information over radio, wire, or fiber optic transmission links. QAM is a combination of amplitude and phase modulation and is an extension of multiphase phase-shift-keying. QAM can have any number of discrete digital levels typically including 4, 16, 64 or 256 levels.

          In one embodiment of the present invention, QAM-64 is used in the RF interface 52 for  
20           downstream transmission. In another embodiment of the present invention, QAM-16 or Quadrature Phase-Shift-Keying ("QPSK") is used for upstream transmission. For the upstream embodiment, the symbol rate of upstream transmission may be 160, 320, 640, 1,280, or 2,560 kilo-symbols per second ("ksym/sec") for 16-QAM, or 160, 320, 640, 1,280, or 2,560 ksym/sec



for QPSK. However, other operating frequencies, modulation methods, and symbol rates may alternatively be used. Other information on the RF interface 52 can be found in the Institute of Electrical and Electronic Engineers ("IEEE") standard 802.14 for cable modems, which is incorporated herein by reference. IEEE standards can be found today on the World Wide Web at  
5 the Universal Resource Locator ("URL") "www.ieee.org." However, other RF interfaces 52 could also be used and the present invention is not limited to interfaces complying with IEEE 802.14.

Referring again to FIG. 2, above the RF interface 52 in a data-link layer is a Medium Access Control ("MAC") layer 54. As is known in the art, the MAC layer 54 controls access to  
10 a transmission medium via the physical layer. Information on the MAC layer protocol 54 may be found in DOCSIS. Other information can be found in the IEEE 802.14 for cable modems. However, other MAC layer 54 protocols may alternatively be used and the preferred embodiments are not limited to IEEE 802.14 MAC layer protocols.

Above both the downstream and upstream data-link layers in a network layer 52 is an  
15 Internet Protocol ("IP") layer 58. The IP layer 58, hereinafter IP 58, roughly corresponds to OSI layer 3, the network layer, but is typically not defined as part of the OSI model. As is known in the art, the IP 58 is a routing protocol designed to route traffic within a network or between networks. Additional information on the IP 58 may be found in the Internet Engineering Task Force ("IETF") standard Request For Comments ("RFC") 791 - Internet Protocol, dated  
20 September 1981, incorporated herein by reference.

Also within the network layer of the protocol stack 50, an Internet Control Message Protocol ("ICMP") layer 56 is used for network management. The main functions of the ICMP layer 56, hereinafter ICMP 56, include error reporting, reachability testing (e.g., "pinging"),



congestion control, route-change notification, performance, and subnet addressing. Since the IP 58 is an unacknowledged protocol, datagrams may be discarded and the ICMP 56 is used for error reporting. Additional information on the ICMP 56 may be found in IETF standard RFC 792 - Internet Control Message Protocol, dated September 1981, incorporated herein by  
5 reference.

Above the IP 58 and the ICMP 56 is a transport layer with a User Datagram Protocol (“UDP”) layer 60. The UDP layer 60, hereinafter UDP 60, roughly corresponds to OSI layer 4, the transport layer, but is typically not defined as part of the OSI model. As is known in the art, the UDP 60 provides a connectionless mode of communication with datagrams. Additional  
10 information on the UDP 60 may be found in IETF standard RFC 768 - User Datagram Protocol, dated August 28, 1980, incorporated herein by reference.

Above the network layer are a Simple Network Management Protocol (“SNMP”) layer 62, a Trivial File Transfer Protocol (“TFTP”) layer 64, a Dynamic Host Configuration Protocol (“DHCP”) layer 66 and a UDP manager 68. The SNMP layer 62 is used to support network  
15 management functions. Additional information on the SNMP layer 62 may be found in IETF standard RFC 1157 - A Simple Network Management Protocol (SNMP), dated May 1990, incorporated herein by reference. The TFTP layer 64 is a file transfer protocol used to download files and configuration information. Additional information on the TFTP layer 64 may be found  
in IETF standard RFC 1350 - The TFTP Protocol (Revision 2), dated July 1992, incorporated  
20 herein by reference. The DHCP layer 66 is a protocol for passing configuration information to hosts on an IP 54 network. Additional information on the DHCP layer 66 may be found in IETF standard RFC 2131 - Dynamic Host Configuration Protocol, dated March 1997, incorporated herein by reference. The UDP manager 68 distinguishes and routes packets to an appropriate



service such as, a virtual tunnel known to those skilled in the art. More or few protocol layers could also be used with a data-over-cable system 16.

An operating environment for the cable modem 28 and other network devices of the present invention includes a processing system with at least one Central Processing Unit 5 (“CPU”) and a memory system. In accordance with the practices of persons skilled in the art of computer programming, the present invention is described below with reference to acts and symbolic representations of operations that are performed by the processing system, unless indicated otherwise. Such acts and operations are sometimes referred to as being “computer-executed”, or “CPU executed.”

10 It will be appreciated that the acts and symbolically represented operations include the manipulation of electrical signals by the CPU. The electrical signals represent data bits which cause a resulting transformation or reduction of the electrical signal representation, and the maintenance of data bits at memory locations in the memory system to thereby reconfigure or otherwise alter the CPU's operation, as well as other processing of signals. The memory 15 locations where data bits are maintained are physical locations that have particular electrical, magnetic, optical, or organic properties, depending on the type of memory used, corresponding to the data bits.

The data bits may also be maintained on a computer readable medium including magnetic disks, optical disks, organic disks, and any other volatile or non-volatile mass storage system 20 readable by the CPU. The computer readable medium includes cooperating or interconnected computer readable media, which exist exclusively on the processing system or is distributed among multiple interconnected processing systems that may be local or remote to the processing system.



## Upstream data transmission

The upstream channel may be viewed as time-divided into a stream of mini-slots. A mini-slot is used as a unit of granularity for upstream transmission opportunities. A cable modem 28 is permitted to transmit on an upstream channel during a transmission mini-slot allocated by the CMTS 30. When a cable modem 28 wishes to transmit data it must first request permission from the CMTS 30. The CMTS 30 receives requests from a number of cable modems that wish to transmit and may allocate one or more transmission mini-slots to each of the cable modems. The cable modems alternately transmit during the mini-slots. Mini-slots are timed to prevent collisions between the transmissions from different cable modems.

A cable modem 28 that wishes to transmit sends a Request MAC 54 message to the CMTS 30. FIG. 3 is a diagram illustrating a preferred structure of a Request message 70. The Request message 70 includes a frame control field 72 ("FC"), a bandwidth request field 74 ("REQ"), a service identifier field 76 ("SID"), and a MAC 54 header check sequence field 78 ("HCS"). Descriptions for the Request message 70 fields are shown in Table 1.



<b>Request message 70 Parameter</b>	<b>Description</b>
<b>FC 72</b>	Frame control. Identifies type of MAC 54 message.
<b>REQ 74</b>	Total amount of bandwidth requested in mini-slots.
<b>SID 76</b>	Service Identifier for the cable modem 28 that sent the REQ message.
<b>HCS 78</b>	MAC 54 header check sequence.

Table 1

The SID 76 is a unique identifier for the cable modem 28 that is requesting permission to transmit. The SID 76 may be assigned by the CMTS 30 when the cable modem 28 initializes and registers with the CMTS 30 as discussed below. The REQ 74 field contains a measure of how much bandwidth, i.e. mini-slots, the cable modem 28 requests for the transmission of its data to the CMTS 30.

In response, the CMTS 30 builds an Upstream Bandwidth Allocation Map message 80 ("MAP") and transmits it via the downstream channel to all cable modems. FIG. 4 is a block diagram illustrating the structure of a preferred MAP message 80. The MAP message 80 includes a MAC 54 management header field 82, an upstream channel identifier field 84, a upstream channel descriptor count field 86 ("UCD Count"), a number of elements field 88, a reserved field, an allocation start time field 90 ("Alloc Start Time"), an acknowledgement time field 92 ("Ack Time"), a ranging backoff start field 94, a ranging backoff end field 96, a data backoff start field 97, a data backoff end field 99, and a MAP information elements field 100. Descriptions for the MAP message 80 fields are shown in Table 2.



<b>MAP message 80 Parameter</b>	<b>Description</b>
<b>MAC 54 Management Message Header 84</b>	The header of this message identifying it as a MAP message.
<b>Upstream Channel ID 84</b>	The identifier of the upstream channel to which this message belongs.
<b>UCD Count 86</b>	Matched the value of the Configuration Change Count of the UCD which describes the burst parameters which apply to this map.
<b>Number of Elements 88</b>	Number of information elements in the map.
<b>Alloc Start Time 90</b>	Effective start time from CMTS 30 initialization (in mini-slots) for assignments within this map.
<b>Ack Time 92</b>	Latest time, from CMTS 30 initialization, (mini-slots) processed in upstream.
<b>Ranging Backoff Start 94</b>	Initial back-off window for initial ranging contention.
<b>Ranging Backoff End 96</b>	Final back-off window for initial ranging contention.
<b>Data Backoff Start</b>	Initial back-off window for contention data and requests.
<b>Data Backoff End</b>	Final back-off window for contention data and requests.
<b>MAP Information Elements 100</b>	Encoded data blocks that designate the allocation of transmission mini-slots on the upstream channel.

Table 2

The MAP message 80 informs the cable modems 28 of the allocation of mini-slots for a scheduled upstream usage interval and when to begin the usage interval. In a given upstream usage interval, selections of the cable modems 28 alternately transmit on the upstream channel. As is known in the art, each upstream usage interval is composed of transmission intervals, also referred to as "bursts," which comprise at least one mini-slot.

An identifier for the upstream channel to which the MAP message 80 applies is placed in the Upstream Channel ID field 84. The MAP Information Elements field 100 designates the



order and duration of the transmissions from the cable modems 28. Each transmission may be described by one element. The number of elements in the MAP Information Elements field 100 is placed in the Number of Elements field 88.

FIG. 5 is a block diagram illustrating a preferred structure of MAP Information Elements 100. The MAP Information Elements field 100 designate intervals for transmissions by the cable modems 28 within the usage interval. Each interval includes a field for the SID 76 of the cable modem 28 that is permitted to transmit in each interval. The Interval Usage Code field 102 ("IUC") informs the cable modem 28 what kind of upstream transmission is permitted in the interval. The offset field 104 specifies when the transmission interval occurs. In this manner, the series of intervals permit the selection of cable modems 28 to deliver their data packets to the CMTS 30 without the transmissions colliding on the upstream path.

The IUCs 102 are values that designate the type of transmission that is permitted in each interval. The cable modems 28 may be capable of several types of transmission. For example, the transmission may be for the purposes of ranging, allowing a cable modem 28 to compensate for delay on the cable network. Additionally, the transmission may be for the purpose of delivering a data packet to the CMTS 30. Two types of data transmissions are typically permitted: a short data grant or a long data grant. These data grants have corresponding IUCs 102 as described in DOCSIS. For example, a short data grant may be appropriate when the CPE 14 only has a small amount of data to transmit on the upstream channel, such as a few keystrokes or the opening of a hyperlink on a web page. A long data grant may be appropriate when the CPE 14 requests to transfer a file through the backbone network 12.



As alternatives to the foregoing, other field settings for the Request message 70, the MAP message 80, and the MAP Information Elements 100 may be used. It should further be understood that other field structures and values may be used.

#### **Parameters for upstream data transmission**

5        Additionally, data packets that are transmitted in adjacent mini-slots may be transmitted according to different transmission formats for the RF interface 52. The formats are associated with parameters for data transmission. In one exemplary preferred embodiment of the present invention, the parameters for upstream data transmission include the symbol rate, the upstream channel frequency, the modulation type, the preamble, and Forward Error Correction ("FEC")  
10    parameters as described in Table 3.

<b>Parameter for data transmission</b>	<b>Description</b>
<b>Frequency</b>	Center frequency of upstream channel (Hz).
<b>Symbol rate</b>	Multiples of base rate of 160 ksym/sec.
<b>Modulation type</b>	QPSK or 16-QAM.
<b>Preamble</b>	Training sequence of bits used for automatic gain control and modulation.
<b>FEC level (T)</b>	Amount of redundant bytes that are added to correct for errors.
<b>FEC data coverage size (k)</b>	Amount of bytes over which error correction is to be performed.

Table 3

As is known in the art, FEC adds redundant bits to the data packet to detect, locate, and correct transmission errors. The FEC level ("T") is a measure of the amount of redundant data that must be added to the data packet to allow for error correction. A higher value of T provides a better  
15    level of error correction. The FEC data coverage size ("k") is a measure of the amount of



information over which data correction is to be performed. For the same FEC level, an increase in the FEC data coverage size will result in more errors going uncorrected. It should be understood that many more data transmission parameters are possible and that the present invention is not restricted to the parameters described herein.

5           Each cable modem 28 transmitting in an upstream usage interval may transmit according to a different transmission format. Additionally, between upstream usage intervals, the cable modem 28 may each undergo reconfiguration so that their future transmissions occur according to another format. The CMTS 30 may reconfigure the cable modems 28 by issuing an Upstream Channel Descriptor ("UCD") message. FIG. 6 is a block diagram illustrating a preferred  
10 structure of a UCD message. The UCD message 110 includes a MAC 54 Management Message Header field 112, an upstream channel identifier field 114, a configuration change count field 116, a mini-slot size field 118, a downstream channel identifier field 120, a type-length-value ("TLV") encoded channel descriptor field 122, and TLV encoded burst descriptor field 124. Descriptions for the UCD message 110 fields are shown in Table 4.



<b>UCD message 110 Parameter</b>	<b>Description</b>
<b>MAC 54 Management Message Header 112</b>	The header of this message identifying it as a UCD message.
<b>Upstream Channel ID 114</b>	The identifier of the upstream channel to which this message belongs.
<b>Configuration Change Count 116</b>	CMTS 30 increments by one whenever any descriptors change.
<b>Mini-Slot Size 118</b>	The duration of a mini-slot.
<b>Downstream Channel ID 120</b>	The identifier of the downstream channel on which this message has been transmitted.
<b>TLV Encoded Channel Descriptors 122</b>	Data blocks which describe the parameters for data transmission to be implemented for the overall channel.
<b>TLV Encoded Burst Descriptors 124</b>	Data blocks which describe the parameters for data transmission to be implemented for each burst.

Table 4

TLV encoding is known to those skilled in the art. A selection of parameters for the overall channel and the bursts are given in Table 3 above. These parameters may be encoded as channel or burst descriptors and incorporated into a UCD message 110 to reconfigure cable modems 28. However, it should be understood that other field structures and values for the UCD message 110 could be used for the present invention.

When the CMTS 30 changes the data transmission parameters for an upstream channel, it builds a UCD message 110 with channel and/or burst descriptors that correspond to the new parameters. The UCD message 110 is sent on the downstream channel 26 to the cable modems 28. The CMTS 30 also sends out a corresponding MAP message 80. The burst descriptors in the UCD message 110 correspond to the IUC fields 102 of the MAP Information Elements 100 of the MAP message 80. As each cable modem 28 transmits on the upstream channel it may be



doing so according to data transmission parameters that are different from other cable modems 28. In this manner, the cable modems 28 within an upstream usage interval may alternately transmit data packets to the CMTS 30 according to independent data transmission parameters.

### **Initialization of a cable modem**

5 Cable modem 28 data transmissions are scheduled and configured as discussed above. However, when a new cable modem joins the data-over-cable system, it must gain access to the system by undergoing an initialization procedure before it is permitted to transmit data. The procedure is typically divided into several phases:

1. Removable Security Module ("RSM") detection;
- 10 2. Scan for downstream channel and establish synchronization with the CMTS 30;
3. Obtain upstream transmission parameters from a UCD 110 message;
4. Perform Ranging;
5. Establish IP 58 connectivity;
6. Establish time of day;
- 15 7. Establish Security Association (if the RSM is present);
8. Transfer operational parameters; and
9. Initialize Baseline Privacy (if RSM is not present and if needed).

In the ranging phase, the cable modem 28 and CMTS 30 compare timers to detect delays in propagation of signals from the cable modem 28 to the CMTS 30. One source of the delay 20 includes finite propagation times in the physical cable medium. The delays are typically larger than burst times and can lead to timing errors if left uncompensated.

The ranging phase discerns a timing offset such that the cable modem's 28 transmissions are aligned to the appropriate mini-slot boundary. Ranging adjusts each cable modem's 28 timing offset such that the cable modem 28 appears to be physically located right at the CMTS 25 30. The cable modem 28 transmits prematurely by an amount equal to the timing offset to



ensure that the signal arrives at the CMTS 30 just when it is expected. Other transmission parameters, such as transmitted power from the cable modem 28, are also adjusted during the ranging phase.

After obtaining the upstream transmission parameters from a UCD 110 message, the cable modem 28 begins the ranging process. First, the cable modem 28 monitors MAP messages 80 and inspects the MAP Information Elements 100. As described above in relation to FIG. 5, the MAP Information Elements 100 designate intervals for cable modem 28 transmission within the usage interval covered by the MAP message 80. Each MAP Information Element 100 corresponds to a transmission interval, identifies which cable modem 28 is permitted to transmit in the interval using a Service Identifier 76 for the cable modem 28, specifies what type of transmission is permitted using an Interval Usage Code 102, and tells the cable modem 28 when to begin transmission using an offset 104. As described above and in DOCSIS, the types of permitted transmission for the interval include a short data grant and a long data grant. Additionally, the IUC 102 may indicate that the interval is to be used for Initial Maintenance or Station Maintenance as is known to those skilled in the cable modem art.

The cable modem 28 finds a MAP Information Element 100 in the MAP messages 80 that has an IUC 102 indicating an Initial Maintenance interval. The CMTS 30 has reserved this time interval for receiving ranging signals from any cable modems 28 that are initializing. It is during this interval that the cable modem 28 will start the ranging phase. The Initial Maintenance interval is a contention interval and many cable modems 28 may use this interval to start ranging. Because the cable modems 28 have not yet registered, the cable modem 28 have not been assigned SIDs 76 by the CMTS 30. The SID 76 for the Initial Maintenance interval in the MAP Information Elements 100 is typically a broadcast/multicast SID 76.



When the Initial Maintenance interval occurs, the cable modem 28 sends a ranging request (“RNG-REQ”) message upstream to the CMTS 30. FIG. 7 is a block diagram illustrating a preferred structure of a RNG-REQ message 130. The Ranging Request message 130 includes a MAC 54 management header field 132, a service identifier field 76, a downstream channel  
5 identifier field 120, and a pending till complete field. Descriptions for the RNG-REQ message 130 fields are shown in Table 5.



<b>RNG-REQ message 130 Parameter</b>	<b>Description</b>
<b>MAC 54 Management Message Header 132</b>	The header of this message identifying it as a Ranging Request message.
<b>SID 76</b>	<p>For RNG-REQ messages transmitted in Initial Maintenance intervals:</p> <ol style="list-style-type: none"> <li>1. Initialization SID if cable modem 28 is attempting to join the network;</li> <li>2. Initialization SID if cable modem 28 has not registered and is changing downstream channels;</li> <li>3. Temporary SID if cable modem 28 has not yet registered and is changing upstream channels; and</li> <li>4. Registration SID if cable modem 28 is registered and is changing upstream channels.</li> </ol> <p>For RNG-REQ messages transmitted in Station Maintenance intervals: Assigned SID.</p>
<b>Downstream Channel ID 134</b>	The identifier of the downstream channel on which the cable modem 28 received the initial UCD message 110.
<b>Pending Till Complete</b>	<p>If zero, all previous Ranging Response attributes have been applied prior to transmitting this RNG-REQ.</p> <p>In non-zero, this is the time estimated to be needed to complete assimilation of ranging parameters.</p>

Table 5

The initialization SID 76 that the cable modem 28 places in the SID 76 field of the RNG-REQ message 130 is typically zero. This indicates to the CMTS 30 that the cable modem 28 has



not registered before. If the SID 76 is non-zero, the CMTS 30 assumes that the cable modem 28 has previously undergone initialization but on another upstream channel.

In response to receiving the RNG-REQ message 130 from the cable modem 28, the CMTS 30 transmits a Ranging Response (“RNG-RSP”) message 140. FIG. 8 is a block diagram  
5 illustrating a preferred structure of a RNG-RSP message 140. The Ranging Response message 140 includes a MAC 54 management header field 142, a service identifier field 76, an upstream channel identifier field 144, and a TLV encoded ranging information field 124. Descriptions for the RNG-RSP message 140 fields are shown in Table 6.



<b>RNG-RSP message 140 Parameter</b>	<b>Description</b>
<b>MAC 54 Management Message Header 142</b>	The header of this message identifying it as a Ranging Response message.
<b>SID 76</b>	<p>For RNG-REQ messages transmitted in Initial Maintenance intervals that had an initialization SID: Assigned temporary SID.</p> <p>For RNG-REQ messages not transmitted in Initial Maintenance intervals that had an initialization SID: Same SID as in RNG-REQ.</p> <p>If instructing cable modem 28 to move to a different channel: Initialization SID.</p>
<b>Upstream Channel ID 144</b>	The identifier of the upstream channel on which the CMTS 30 received the RNG-REQ message.
<b>TLV encoded ranging information 146</b>	<p>Includes:</p> <ol style="list-style-type: none"> <li>1. Timing adjust information;</li> <li>2. Power adjust information;</li> <li>3. Frequency adjust information;</li> <li>4. cable modem 28 transmitter equalization information;</li> <li>5. Ranging status;</li> <li>6. Downstream frequency override; and</li> <li>7. Upstream channel ID override.</li> </ol>

Table 6

During the initial ranging, the RNG-RSP message 140 contains a temporary SID 76 for the cable modem 28. This SID 76 identifies the cable modem 28 to the CMTS 30 until it has completed a registration process. The RNG-RSP message 140 also includes information on RF power adjustments, transmission frequency adjustments, and offset timing adjustments that the cable



modem 28 should adopt so as to improve communications from the cable modem 28 to the CMTS 30.

In response to the RNG-RSP message 140, the cable modem 28 monitors the downstream channel and examines the MAP 80 messages. In particular, the cable modem 28 looks for a  
5 MAP Information Element 100 in the MAP messages 80 that has an IUC 102 indicating a Station Maintenance interval and an associated SID 76 field containing the temporary SID 76 assigned to the cable modem 28. The CMTS 30 has reserved this time interval for receiving ranging signals from only the cable modem 28 associated with the temporary SID 76.

When the Station Maintenance interval occurs, the cable modem 28 sends another RNG-  
10 REQ message 130 upstream to the CMTS 30. In return, the CMTS 30 returns a RNG-RSP message 140 with appropriate corrections to the transmission parameters in the ranging information field 146. The sequence of RNG-REQ 130 and RNG-RSP 140 is repeated until the CMTS 30 sends a RNG-RSP message 140 notifying the cable modem 28 that the ranging is successful.

15 FIG. 9 is a block diagram illustrating a typical message flow 160 during cable modem 28 initialization. The CMTS 30 sends a UCD 110 message 162 downstream describing the parameters for transmission in the upstream channel. The cable modem 28 receives the UCD message 162, extracts the transmission parameters from the UCD message 162, and configures itself to transmit with these parameters at step 164. The cable modem 28 then monitors the  
20 downstream channel for a MAP 80 message. When the cable modem 28 receives a MAP message 166, the cable modem 28 determines when the next Initial Maintenance interval will occur at step 168.



During the Initial Maintenance interval 170, the cable modem 28 sends a RNG-REQ message 172 upstream to the CMTS 30. The RNG-REQ message 172 may have its SID field 76 set to zero to indicate that the cable modem 28 is initializing. The CMTS 30 receives the RNG-REQ message 172 and selects a temporary SID for the cable modem 28 at step 174. The CMTS 30 sends a RNG-RSP message 176 with this temporary SID to the cable modem 28. The cable modem 28 adopts this temporary SID as its identifier at step 177.

The cable modem 28 waits for another MAP message 178 that includes a MAP information element 100 for a Station Maintenance interval for the temporary SID at step 180. When this Station Maintenance interval arrives at step 182, the cable modem 28 transmits another RNG-REQ message 184 upstream to the CMTS 30. In response, the CMTS 30 determines adjustments to the cable modem 28 transmission parameters at step 186 and transmits the parameters to the cable modem 28 in a RNG-RSP message 188. The cable modem 28 receives the RNG-RSP message 188 and correspondingly adjusts its transmission parameters at step 190.

#### **Initial upstream transmit levels for cable modems**

At present, a cable modem 28 arbitrarily selects an initial transmit level when sending a RNG-REQ message 130 during an Initial Maintenance interval. Typically, a cable modem 28 starts transmitting with a minimum specified transmit power level (typically 8 dBmV) for the first RNG-REQ message 130. If there is no returned RNG-RSP message 140 in response to the RNG-REQ message 130, the cable modem 28 increases the power level and transmits another RNG-REQ message 130. This process is repeated until a RNG-REQ message 130 is acknowledged by the CMTS 30 in the form of a RNG-RSP message 140. Unfortunately, this



process may be slow since the cable modem 28 may be required to attempt ranging many times until the transmit level is of sufficient magnitude to be recognized by the CMTS 30.

In addition, multiple attempts at initial ranging may increase the probability of collisions with RNG-REQ messages 130 from any other cable modems 28 that are undergoing  
5 initialization in the same Initial Maintenance interval. Reducing the probability of collisions may be accomplished by changing the ranging backoff parameters (94,96) in a MAP message 80. However, changing the ranging backoff parameters (94,96) to reduce collisions has the advantage of increasing the time between cable modem 28 RNG-REQ messages 130. The cable  
10 modem 28 will still gradually increase its transmit level from the minimum transmit level until it is recognized by the CMTS 30, although now the time between these level increases is longer. This may further increase the time it takes for a cable modem 28 to initialize. Therefore, changing ranging backoff in a MAP message 130 does not necessarily lead to a decreased  
initialization time for a cable modem 28 but may more likely prolong cable modem 28 initialization.

15 The difficulty of estimating a proper initial transmit level may be appreciated with reference to FIG. 10. FIG. 10 is a block diagram illustrating a configuration of a Hybrid Fiber/Coaxial (HFC) network 200. An output of an O/E node 202 feeds RF signals downstream 222 first to a bi-directional RF amplifier 210. The first amplifier 210 delivers the downstream  
20 signal to customers by means of taps 204 (represented by squares) and splitters 206 (represented by circles). A tap 204 is a drop point on a RF coaxial distribution cable that permits a portion of the RF signal to be diverted to customers by means of drop cables. A splitter 206 divides input  
RF power between two or more outputs. As illustrated in FIG. 10, the downstream RF output 220 of the first amplifier 210 is split between two other bi-directional amplifiers on the right 212



and left 214. The left amplifier 214 forwards the downstream RF signal through one output 218 to a tap and through another output 216 to a series of taps. The cable modem 28 receives the downstream RF signal from the second tap from the latter output 216. Although not illustrated, additional cable modems 28 are typically coupled to the outer tap 204.

5 In the upstream direction of FIG. 10, the cable modem 28 has to send its RF signal through two taps to an upstream input 216 of the left amplifier 214, through the splitter between the left 214 and right 212 amplifiers, to the upstream input 220 of the first amplifier 210. The upstream RF signal is then received by the upstream input to the O/E node 202 where it is eventually delivered to the CMTS 30. As can be seen from FIG. 10, the upstream signal has to  
10 wind its way back up the cable network 200 through many different pieces of RF equipment.

Typically, HFC networks are designed for unity gain in a reverse direction. That is, the signal level at the upstream input to each amplifier is the same. For example, suppose cable modem 28 launches a signal that is at a level of "X" dBmV as measured at the upstream input 216 of the left amplifier 214. Unity gain means that when the signal traverses the network to the  
15 upstream input 220 of the next amplifier 210, the level will again be "X" dBmV. The left amplifier's 214 upstream gain is adjusted so that the levels are the same at points 216 and 220. The amplifiers are configured such that the same signal level occurs at each upstream input in the signal path back to the CMTS 30.

If the cable modem 28 could know in advance what its required level at the upstream  
20 inputs should be, and if it could know the loss from its location back to the upstream input, it would be able to determine the proper transmit level. By the nature of HFC designs, the reverse path loss from each cable modem 28 back to the first encountered upstream input will be different. In the downstream direction, taps that are closer to the output of an amplifier more



strongly attenuate the downstream signal compared to taps that are farther from the output. Thus cable modems 28 that are closest to the upstream input will typically be fed by a high value tap compared to cable modems 28 that are farther from the upstream input. Consequently, their upstream path loss will be large compared to the upstream path loss for a cable modem 28 farther downstream. Cable modems 28 that are fed by the last tap before the next amplifier downstream will be fed by a lower value tap and will therefore have a lower loss back to an upstream input. With various drop lengths and inside wiring configurations, this difference between locations could typically be greater than 20 dB. Due to such a variation in loss, a fixed loss value cannot be used to estimate a proper transmit level for a cable modem 28.

10 In addition, the loss spectrum varies with location. Passive insertion loss occurs in devices such as taps and splitters, and it is typically linear and flat across the cable RF spectrum. However, attenuation loss from the hard line and drop cable that connects the amplifiers, taps, and splitters to the cable modem 28 is frequency dependent. Attenuation loss typically increases exponentially with frequency. Additionally, the difference in attenuation loss between two frequencies increases with cable length due to dielectric effects in the cable.

15 An estimate of loss in the upstream direction to the nearest amplifier at the upstream frequency may enable the cable modem 28 to determine a proper transmit level. The transmit level would be such that the RF power is at the appropriate level when the signal reaches the input of the nearest amplifier. Injecting a signal at the proper transmit level may ensure that the CMTS 30 receives a RNG-REQ message 130 from the cable modem 28 after only a few attempts at initial ranging. A minimal number of RNG-REQ messages 130 transmitted by multiple initializing cable modems 28 may also result in fewer collisions and hence a shorter initialization time for all cable modems 28.



## Estimating an initial upstream transmit level

In accordance with a preferred embodiment, an estimate of loss in the upstream direction to the nearest amplifier is determined by estimating loss in the downstream direction from the nearest amplifier. Similar to the upstream path, the downstream path is expected to have consistent setup levels at the outputs of the amplifiers. The levels may be different for trunk and feeder lines, but since taps are typically not placed on trunk lines, levels at the outputs to feeder lines may be used as a reference. Cable networks 26 are typically configured such that the setup level at downstream outputs is consistent across the system and the setup level at the upstream inputs is also consistent, as described above.

For example, a downstream output from a typical amplifier, e.g. the left amplifier 214, may have a output setup level of 35 dBmV as measured at a frequency of 55 MHz and 44 dBmV as measured at a frequency of 750 MHz. The output level as set up is typically greater at the higher frequency to pre-compensate for higher frequency attenuation loss in the cable. The same bi-directional amplifier 214 may also require an upstream input setup level of 15 dBmV. Signal levels in both directions are measured at the downstream output/upstream input 216 to the amplifier 214. If the cable modem 28 receives the downstream signal from the amplifier 214 and measures the signal level at 55 MHz (channel 2) to be 5 dBmV, an estimate of the path loss may be determined to be 30 dB. Armed with an estimate of 30 dB loss for the path, therefore, one approach to decrease ranging time is to allow the cable modem 28 to set its transmit level to 15 dBmV + 30 dB = 45 dBmV in order that its upstream transmissions reach the amplifier at the required signal strength.

This transmit level, however, may be an overcompensation. It may be too large because the loss in the 5-42 MHz range, within which typical upstream channel frequencies reside, will



be less than that at 55 MHz. The estimated 45 dBmV launch power may need to be scaled back accordingly to prevent the upstream signal from overdriving the amplifier at the upstream frequency. Additionally, to prevent overdriving, the estimated transmit level may also be reduced by a margin to compensate for deviations in setup levels that may exist across the cable network 200.

Thus, in accordance with a more preferable approach, an estimate for the transmit level of the cable modem 28 may be derived from a measurement of the signal level received by the cable modem 28 and setup parameters of the network 26, for example as shown in Equation 1:

$$T_{CM} = I_{amp} + ( O_{amp} - R_{CM} - F - M ) \quad (1)$$

10 where  $T_{CM}$  is the estimated transmit level of the cable modem 28. In Equation 1,  $I_{amp}$  is the expected (setup) upstream input to an amplifier and the term in brackets represents the estimated loss in the path from the amplifier to the cable modem 28. The estimated loss in the path is the difference between the expected (setup) output level of the amplifier, as measured at the frequency of the lowest channel,  $O_{amp}$ , and the measured level of signals received by the cable  
15 modem 28 at the lowest channel,  $R_{CM}$ . The estimated loss is reduced by a value  $F$  reflecting the difference between the loss at the frequency of the lowest downstream channel (or other reference frequency) and the loss at the (lower) frequency of the upstream channel, and further reduced by a value  $M$  for the margin reflecting deviations in the setup values that may occur in the cable network. With reference to the above example,  $I_{amp} = 15$  dBmV,  $O_{amp} = 35$  dBmV, and  
20  $R_{CM} = 5$  dBmV.  $F$  is the difference between the loss measured at 20 MHz and the loss measured at 55 MHz.  $M$  depends on tolerances in the cable network 26, drift in the amplifiers and other system characteristics that may arise from setup inaccuracies. It should be understood, however,



that the present invention is not limited to the above setup parameters of the network and their combination in Equation 1, and that other parameters and combinations are possible.

The estimate of the upstream transmit level from Equation 1 may be recast as shown in Equation 2:

$$T_{CM} = (I_{amp} + O_{amp} - F - M) - R_{CM} \quad (2)$$

The expression inside the brackets includes setup and network parameters and may be replaced by a single value that is characteristic of the cable network 26. Armed with this characteristic value, the cable modem 28 may subtract the measured downstream signal level from the characteristic value to arrive at an estimate for its proper upstream transmit level as described below. Transmitting at this proper level may ensure that the cable modem 28 makes only a few attempts at initial ranging before receiving a RNG-RSP message 140 from the CMTS 30.

FIG. 11 is a flow diagram illustrating a method 250 for estimating an initial transmit level for a cable modem 28 to range on an upstream channel. The method 250 includes ascertaining a characteristic value for a data-over-cable system at step 252. The characteristic value is associated with expected values for configuration parameters in the system. At step 254, a signal level of a downstream channel is measured at the cable modem 28. The initial transmit level for the cable modem 28 is set at step 256. The set initial transmit level is a difference between the characteristic value determined at step 252 and the signal level of the downstream channel measured at step 254. In this manner, the cable modem 28 begins its ranging at the initial transmit level and may be recognized by the CMTS 30 sooner than if the cable modem 28 had begun ranging at a minimum specified transmit level.



differential, and a margin are provided to a cable modem 28 inside a UCD message 110. An appropriate TLV encoding of these values may be included as descriptors of the upstream channel in the TLV encoded channel descriptor field 122 of the UCD message 110. Alternatively, in another exemplary preferred embodiment, since these numbers will be summed  
5 to generate the estimate, a single entry which provides a summed characteristic value may be included in the TLV encoded channel descriptor field 122 of the UCD message 110. In the TLV channel parameters, a new type parameter may be declared to indicate to the cable modem 28 that the TLV channel descriptor includes a value or values for setting the initial upstream transmit level. In yet another exemplary preferred embodiment, if the UCD message 110 does  
10 not include a value or values, the cable modem 28 may use default values stored in its memory as a backup.

#### **Dynamically adjusting the estimated initial transmit level**

The characteristic value above is used to calculate an estimated initial transmit level. This value is derived from expected static parameters for the cable network 26. The network 26,  
15 however, may deviate from its expected behavior. Moreover, the deviation may vary with time as cable modems 28 join the cable network 26. Faults in the physical plant of the cable network 26, e.g. failed splitters, damaged cable line or misbehaving amplifiers, may occur at any time and may not be anticipated by the cable company. Impairments in signal transmission may develop from a noisy cable modem 28 or an interfering external RF source. Signal degradation may  
20 occur from cross-talk between cable modems 28 on upstream cable paths, bugs in one or more cable modem's 28 software for time division multiplexing, or flaws in the O/E nodes 24 in the data-over-cable system 16.



If the estimated initial transmit level is not high enough, the first RNG-REQ messages 130 from the cable modem 28 may still not be of sufficient strength to be recognized by the CMTS 30. As described above, the cable modem 28 increases its transmit level and sends another RNG-REQ messages 130. The cable modem 28 continues increasing its level and transmitting until the CMTS 30 responds. Even though the cable modem 28 starts its stepwise increase in level from the higher, estimated, baseline initial transmit level as calculated above, the cable modem 28 may still have to send many RNG-REQ messages 130 until it receives a RNG-RSP message 140.

Real time adjustment of initial transmit values for initiating cable modems 28, may be achieved by allowing each cable modem 28 that has successfully ranged to report a difference between its final transmit level and its estimated initial transmit level. The information from the initialized cable modems 28 could be collected by the CMTS 30 and manipulated, e.g. by averaging, weighting, or some other statistical method, to provide an implementation delta value,  $\Delta$ . This implementation delta value may be added to the above estimated initial transmit level to compensate for anomalies in a given network that may be the result of incorrect set up levels, unforeseen additional losses in one path but not the other, or other factors. In this manner, initial transmit levels may be adjusted such that station equipment is not overdriven, or such that initial RNG-REQ messages 130 generate responses within a few attempts.

FIG. 12 is a flow diagram illustrating a method 260 for adjusting an initial transmit level for a cable modem 28 to range on an upstream channel. The method 260 includes receiving an implementation delta value on the cable modem 28 in a message from the CMTS 30 at step 262. The implementation delta value represents a dynamical correction to an initial transmit level that is responsive to changes in the data-over-cable network. At step 264 the initial transmit level is



adjusted by adding the implementation delta value. In this manner, the cable modem 28 begins ranging at the adjusted initial transmit level and is likely to be recognized by the CMTS 30 with fewer attempts than if the cable modem 28 began ranging at a minimum specified transmit level.

In another exemplary preferred embodiment of the present invention, the implementation  
5 delta value is sent to the cable modem 28 via a UCD message 110. The implementation delta value occurs in a TLV encoded channel descriptor field 122 of the UCD message 110. Sending the implementation delta value to the cable modem 28 by a UCD message 110 may be more appropriate if the delta value changes infrequently. All cable modems 28 on the cable network  
26 process the UCD message 110 and may result in extensive processing if the delta value  
10 changes more frequently.

In yet another exemplary preferred embodiment of the present invention, the implementation delta information is sent to the cable modem 28 via a new entry in a MAP message 80. If this delta value is changing frequently, the MAP 80 may be a better vehicle for transport versus a UCD 110 since each MAP 80 is different whereas a UCD 110 may tend to  
15 remain constant in time. The implementation delta value could be placed in the MAP 80 as a MAP information element 100 using a reserved IUC 102, a broadcast/multicast SID 76, and an offset 104 equal to the MAP 80 length. As is known in the art, such a MAP information element 100 would behave like a data acknowledgement. Once received by a cable modem 28, the implementation delta value is added to the estimated initial transmit level received from a UCD  
20 110 message as described above. A dynamically adjusted estimate of the initial transmit level is thus shown in Equation 3:

$$T_{CM} = ( I_{amp} + O_{amp} - F - M ) + \quad - R_{CM} \quad (3)$$



The first parameters in the brackets may be received from the CMTS 30 in a UCD message 110, either separately or as a single value. This may occur when the cable modem 28 first retrieves the parameters for upstream transmission, e.g. in the UCD message 162 of FIG. 9. The implementation delta parameter may be received from the CMTS 30 in a MAP message 80. This  
5 may occur when the cable modem 28 receives a MAP message 80 to find an Initial Maintenance interval, e.g. in the MAP message 166 of FIG. 9. The cable modem 28 measures a value for the downstream signal level  $R_{CM}$  and calculates an estimated initial transmit signal level from Equation 3. After the cable modem 28 has successfully initialized, it conveys a difference value between its final transmit level and this estimated initial transmit signal level to the CMTS 30.  
10 The CMTS 30 collects the difference values from all cable modems 28 on the cable network 26 and determines another value for the implementation delta parameter.

The above method for estimating an initial transmit level may also provide an indication as to the potential cause of a ranging failure. If an estimation of an initial transmit level exceeds its transmit capability, the cable modem 28 may scale the estimated level back to within an  
15 operational range. If the subsequent ranging was successful, the cable modem 28 may not have to do anything further. If ranging failed, however, the cable modem 28 may give an indication to a user of the cable modem 28 that a potential cause of the initialization failure was excessive reverse path loss.

Whether using the initial transmit level from the UCD message 110 or the adjusted initial  
20 transmit level from a MAP message 80, the cable modem 28 examines the MAPs to find the next Initial Maintenance opportunity. With an opportunity found, the cable modem 28 begins the standard ranging procedure starting with the initial transmit level. If ranging and initialization is successful, the cable modem 28 may create a difference value, calculated as the difference



between the final transmit level and the initial transmit level and make it available to the CMTS 30 in a Management Information Base ("MIB"). As is known in the art, a MIB is a repository of information collected for access by a network management protocol. In accordance with a preferred embodiment, the MIB information would be retrieved by the CMTS 30 after each cable modem 28 initialized on the network. The collection of difference values may then be processed by the CMTS 30 with the resultant value placed in the MAP 80 as the implementation delta value. The implementation delta value may be a worse case value, e.g. a maximum of the differences from the multiple cable modems 28. The worse case value typically adjusts the cable modems' 28 initial transmit levels to values that overcompensate for path loss as most cable modems 28 will have had a better success at ranging. Alternatively, the implementation delta value may be a straight or weighted average of the difference values and may depend on the margin parameter M of the network.

It should be understood that the programs, processes, methods, systems and apparatus described herein are not related or limited to any particular type of computer apparatus (hardware or software), unless indicated otherwise. Various types of general purpose or specialized computer apparatus may be used with or perform operations in accordance with the teachings described herein.

In view of the wide variety of embodiments to which the principles of the invention can be applied, it should be understood that the illustrated embodiments are exemplary only, and should not be taken as limiting the scope of the present invention. For example, the Steps of the flow diagrams may be taken in sequences other than those described, and more or fewer elements or component may be used in the block diagrams.



The claims should not be read as limited to the described order or elements unless stated to that effect. In addition, use of the term "means" in any claim is intended to invoke 35 U.S.C. §112, paragraph 6, and any claim without the word "means" is not so intended. Therefore, all embodiments that come within the scope and spirit of the following claims and equivalents thereto are claimed as the invention.



**WE CLAIM:**

1. In a data-over-cable system, a method for estimating an initial transmit level for a cable modem to range on an upstream channel, the upstream channel carrying data transmissions from a plurality of cable modems to a cable modem termination system at a head-end of a cable network, the method comprising the steps of:

5       ascertaining a characteristic value for the data-over-cable system, wherein the characteristic value is associated with configuration parameters for the data-over-cable system;

          measuring a signal level of a downstream channel at the cable modem, wherein the downstream channel carries signals from the head-end to the plurality of cable modems; and

          setting the initial transmit level to a difference between the characteristic value and the  
10   signal level of the downstream channel,

          whereby the cable modem begins ranging at the initial transmit level and is recognized by the cable modem termination system with fewer attempts than if the cable modem began ranging at a minimum specified transmit level.

2. A computer readable medium having stored therein instructions for causing a central processing unit to execute the method of Claim 1.

3. The method of Claim 1 wherein the ascertaining step comprises:

          receiving a message on the cable modem from the cable modem termination system, wherein the message contains the characteristic value.



4. The method of Claim 3 wherein the characteristic value is a combination of the configuration parameters selected from a group consisting of a setup upstream input level, a setup downstream output level for the lowest channel, a frequency differential, or a margin.

5. The method of claim 3 wherein the message is an Upstream Channel Descriptor message.

6. The method of Claim 1 wherein the ascertaining step comprises the steps of:  
receiving a message on the cable modem from the cable modem termination system,  
wherein the message contains the configuration parameters; and  
calculating the characteristic value from the configuration parameters.

5

7. The method of Claim 6 wherein the configuration parameters are selected from a group consisting of a setup upstream input level, a setup downstream output level for the lowest channel, a frequency differential, or a margin.

8. The method of claim 6 wherein the message is an Upstream Channel Descriptor message.

9. The method of Claim 1 wherein the ascertaining step comprises:  
retrieving the characteristic value from memory in the cable modem.



10. In a data-over-cable system, a method for adjusting an initial transmit level for a cable modem to range on an upstream channel, the upstream channel carrying data transmissions from a plurality of cable modems to a cable modem termination system at a head-end of a cable network, the method comprising the steps of:

5 receiving an implementation delta value on the cable modem in a message from the cable modem termination system, wherein the implementation delta value represents a dynamical correction to the initial transmit level that is responsive to changes in the data-over-cable network; and

adjusting the initial transmit level by adding the implementation delta value,

10 whereby the cable modem begins ranging at the adjusted initial transmit level and is recognized by the cable modem termination system with fewer attempts than if the cable modem began ranging at a minimum specified transmit level.

11. A computer readable medium having stored therein instructions for causing a central processing unit to execute the method of Claim 10.

12. The method of Claim 10 wherein the message is an Upstream Channel Descriptor message.

13. The method of Claim 10 wherein the message is a Bandwidth Allocation MAP  
5 message.

14. The method of Claim 10 further comprising:



undergoing an initial ranging phase, wherein the cable modem repeatedly transmits to the cable modem termination system with a stepwise increase in signal level beginning with the initial transmit level and ending at a final transmit level when the cable modem receives an acknowledgment;

providing a difference between the final transmit level and the initial transmit level to the cable modem termination system,

whereby the cable modem termination system receives the difference from the cable modem and combines the difference with difference values from the plurality of cable modems to update the implementation delta value.

15. The method of Claim 14 wherein the providing step comprises:

storing the difference in a Management Information Base on the cable modem, wherein entries in the Management Information Base are able to be read by the cable modem termination system.

16. In a data-over-cable system, a method for improving ranging of a plurality of cable modems on an upstream channel, the upstream channel carrying data transmissions from the plurality of cable modems to a cable modem termination system at a head-end of a cable network, the method comprising the step of:

sending configuration information in a message from the cable modem termination system to the plurality of cable modems, wherein the configuration information is combined with a signal level for downstream transmissions as measured by a cable modem to provide an estimate for an initial transmit level for the cable modem during ranging,



whereby the cable modem begins ranging at the initial transmit level and is recognized by  
10 the cable modem termination system with fewer attempts than if the cable modem began ranging  
at a minimum specified transmit level.

17. A computer readable medium having stored therein instructions for causing a  
central processing unit to execute the method of Claim 16.

18. The method of Claim 16 wherein the configuration information are configuration  
parameters selected from a group consisting of a setup upstream input level, a setup downstream  
output level for the lowest channel, a frequency differential, or a margin.

19. The method of Claim 16 wherein the configuration information is a characteristic  
value which is a combination of configuration parameters selected from the group consisting of a  
setup upstream input level, a setup downstream output level for the lowest channel, a frequency  
differential, or a margin.

5

20. The method of Claim 16 wherein the message is an Upstream Channel Descriptor  
message.

21. In a data-over-cable system, a method for improving ranging of a plurality of  
cable modems on an upstream channel, the upstream channel carrying data transmissions from  
the plurality of cable modems to a cable modem termination system at a head-end of a cable  
network, the method comprising the steps of:



5           ascertaining an implementation delta value on the cable modem termination system from  
difference values provided by the plurality of cable modems; and

          sending the implementation delta value in a message from the cable modem termination  
system to the plurality of cable modems, wherein the implementation delta value is combined  
with an initial transmit level for the cable modem during ranging to adjust the initial transmit  
10   level,

          whereby the cable modem begins ranging at the adjusted initial transmit level and is  
recognized by the cable modem termination system with fewer attempts than if the cable modem  
began ranging at a minimum specified transmit level.

22.    A computer readable medium having stored therein instructions for causing a  
central processing unit to execute the method of Claim 21.

23.    The method of Claim 21 wherein the ascertaining step comprises the steps of:  
receiving the difference values on the cable modem termination system from  
Management Information Bases in the plurality of cable modems; and  
calculating the implementation delta value from the difference values.

5

24.    The method of Claim 23 wherein the calculating step comprises the steps of:  
searching through the difference values to find a maximum value; and  
setting the implementation delta value equal to the maximum value.

25.    The method of Claim 23 wherein the calculating step comprises the steps of:



averaging the difference values to obtain an average difference value; and  
setting the implementation delta value equal to the average difference value.

5           26.    The method of Claim 21 wherein the message is an Upstream Channel Descriptor  
message.

27.    The method of Claim 21 wherein the message is a Bandwidth Allocation MAP  
message.

28.    In a data-over-cable system, a method for estimating an initial transmit level for a  
cable modem to range on an upstream channel, the upstream channel carrying data transmissions  
from a plurality of cable modems to a cable modem termination system at a head-end of a cable  
network, the method comprising the steps of:

5           receiving an Upstream Channel Descriptor message on the cable modem from the cable  
modem termination system, wherein the message contains a characteristic value associated with  
configuration parameters for the data-over-cable system;

measuring a signal level of a downstream channel on the cable modem, wherein the  
downstream channel carries signals from the head-end to the plurality of cable modems;

10          setting the initial transmit level to a difference between the characteristic value and the  
signal level of the downstream channel;

receiving an implementation delta value on the cable modem in a Bandwidth Allocation  
MAP message from the cable modem termination system, wherein the implementation delta



value represents a dynamical correction to the initial transmit level that is responsive to changes  
15 in the data-over-cable network; and

adjusting the initial transmit level by adding the implementation delta value,

whereby the cable modem begins ranging at the adjusted initial transmit level and is  
recognized by the cable modem termination system with fewer attempts than if the cable modem  
began ranging at a minimum specified transmit level.

20

29. A computer readable medium having stored therein instructions causing a central  
processing unit to execute the method of Claim 28.

30. In a data-over-cable system, a method for improving ranging of a plurality of  
cable modems on an upstream channel, the upstream channel carrying data transmissions from  
the plurality of cable modems to a cable modem termination system at a head-end of a cable  
network, the method comprising the step of:

5 sending a characteristic value in an Upstream Channel Descriptor message from the cable  
modem termination system to the plurality of cable modems, wherein the characteristic value is  
combined with a signal level for downstream transmissions as measured by a cable modem to  
provide an estimate for an initial transmit level for the cable modem during ranging;

receiving difference values on the cable modem termination system from Management  
10 Information Bases in the plurality of cable modems;

calculating an implementation delta value from the difference values; and

sending the implementation delta value in a Bandwidth Allocation MAP message from  
the cable modem termination system to a cable modem, wherein the implementation delta value



is combined with an initial transmit level for the cable modem during ranging to adjust the initial  
15 transmit level,

whereby the cable modem begins ranging at the adjusted initial transmit level and is recognized by the cable modem termination system with fewer attempts than if the cable modem began ranging at a minimum specified transmit level.

31. A computer readable medium having stored therein instructions causing a central processing unit to execute the method of Claim 30.

32. The method of Claim 30 wherein the calculating step comprises:  
averaging the difference values to obtain an average value; and  
setting the implementation value equal to the average value.



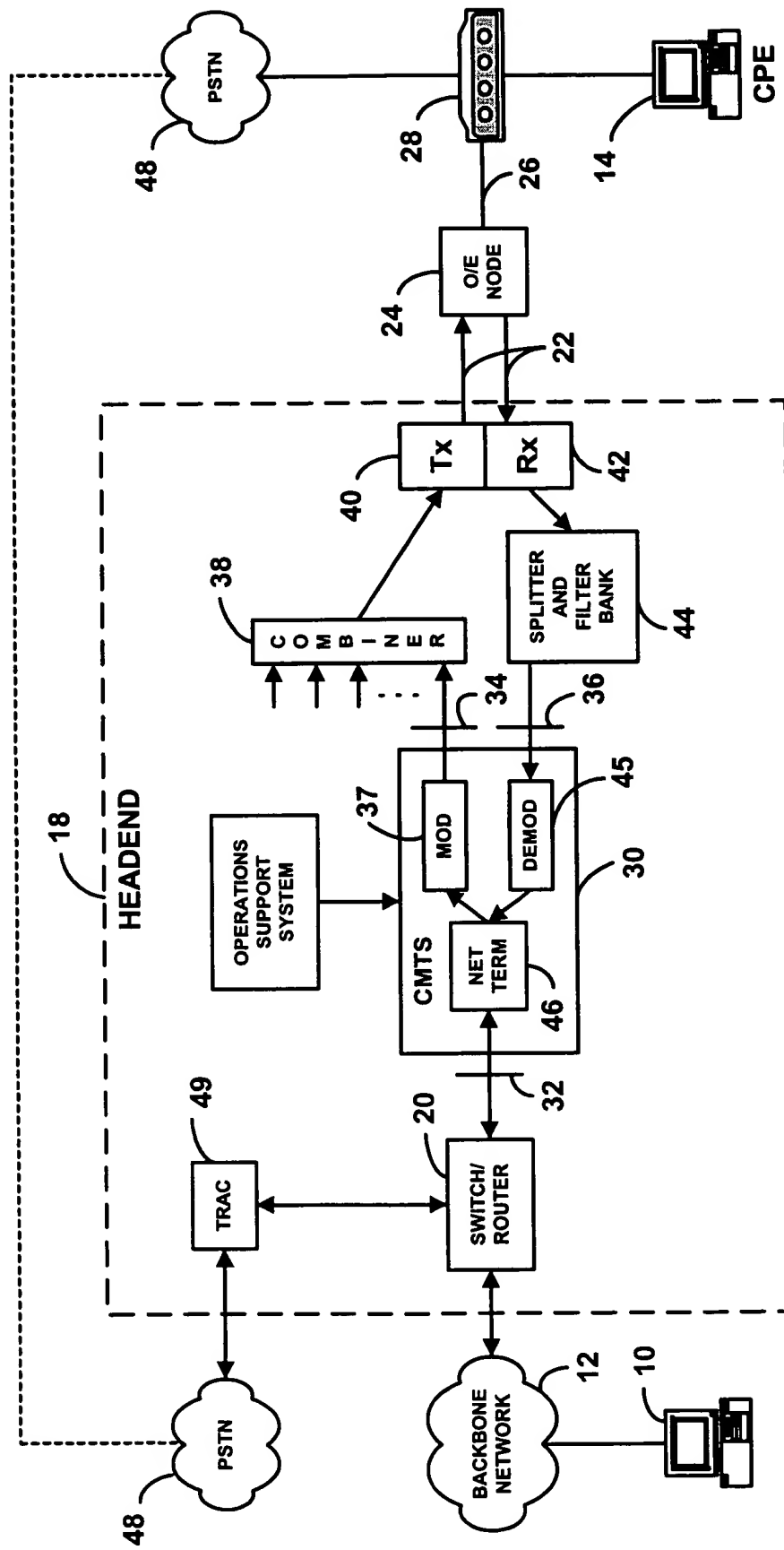
## ABSTRACT

5           Methods for improved cable modem ranging in a data-over-cable system. One method includes receiving a value that characterizes how equipment in the network is configured. Using this characteristic value, a cable modem may estimate loss in its upstream path from a measurement of a downstream signal and thereby estimate its initial transmit level during ranging. Launching at a proper initial transmit level may ensure that range request messages  
10 arrive at the cable modem termination system with sufficient strength to be detected and hence ameliorate ranging. Another method collects difference between these estimated initial transmit levels and the final transmit levels that succeeded in evoking a response from the cable modem termination system. The collected differences are analyzed and the result of the analysis is passed to cable modems to adjust their estimated initial transmit levels. These methods may  
15 shorten a cable modem's time for ranging and may decrease collisions on the upstream path when many cable modems try to range simultaneously.



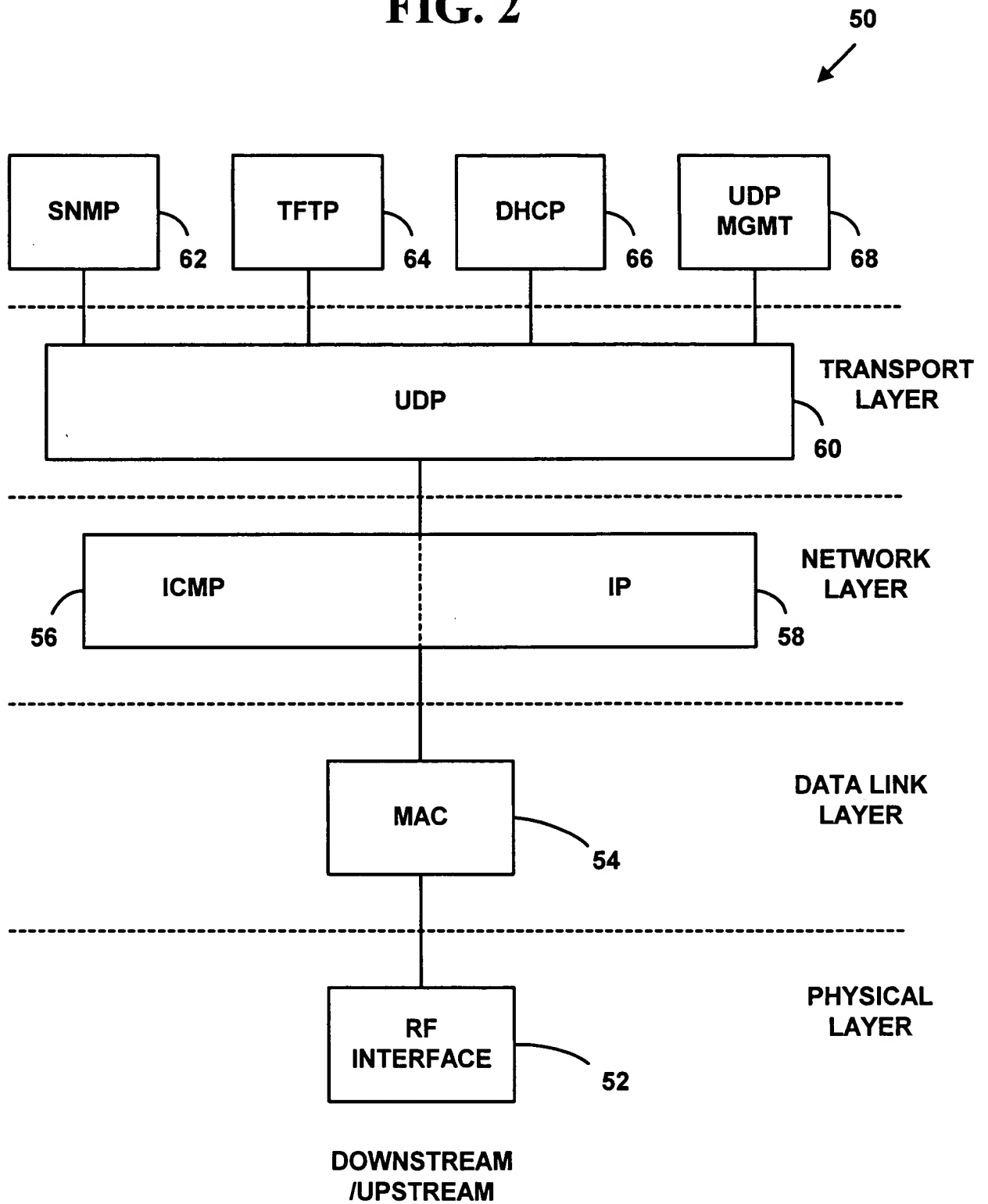
FIG. 1

16



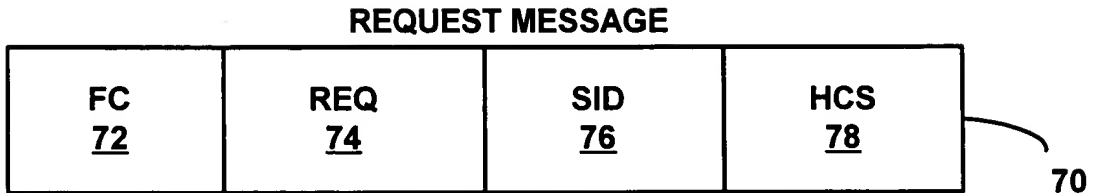


**FIG. 2**

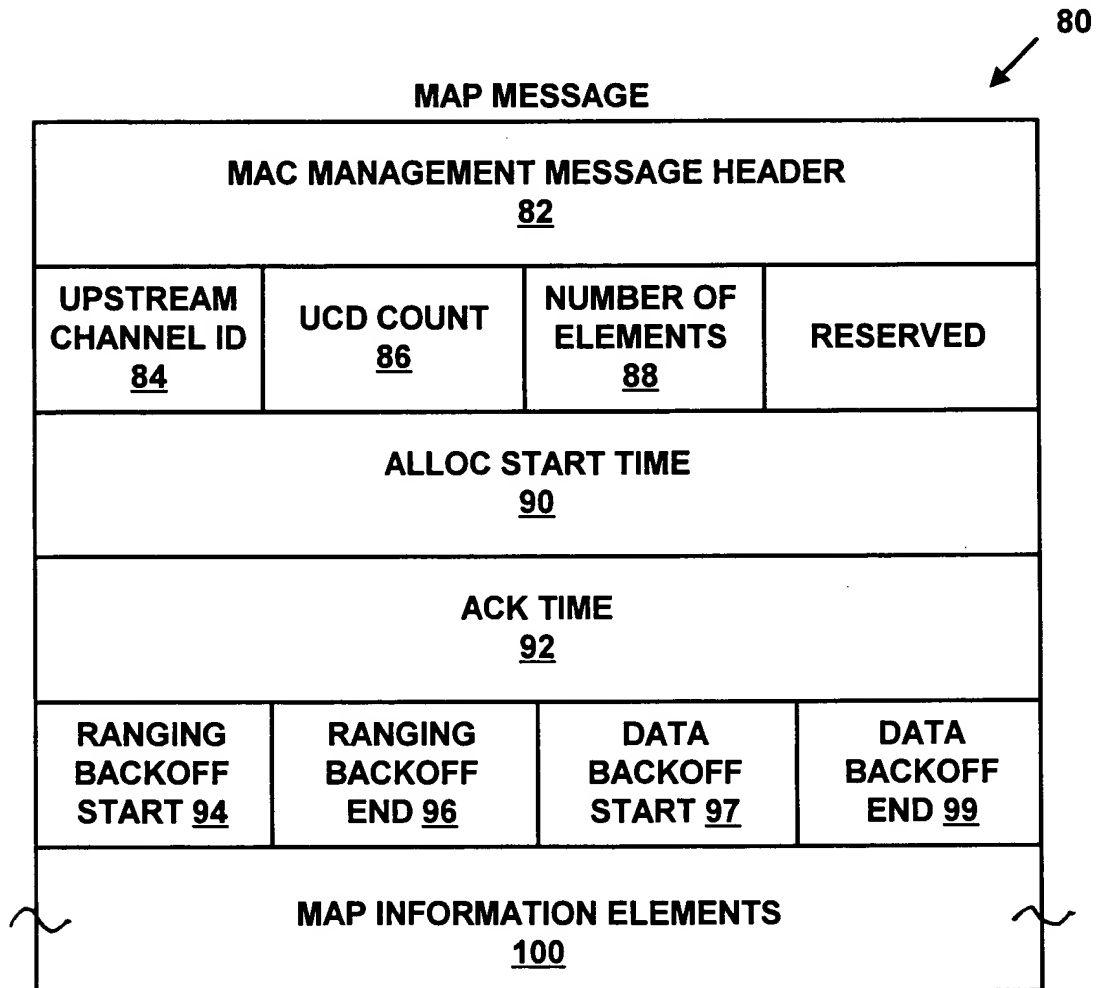




**FIG. 3**



**FIG. 4**





**FIG. 5**

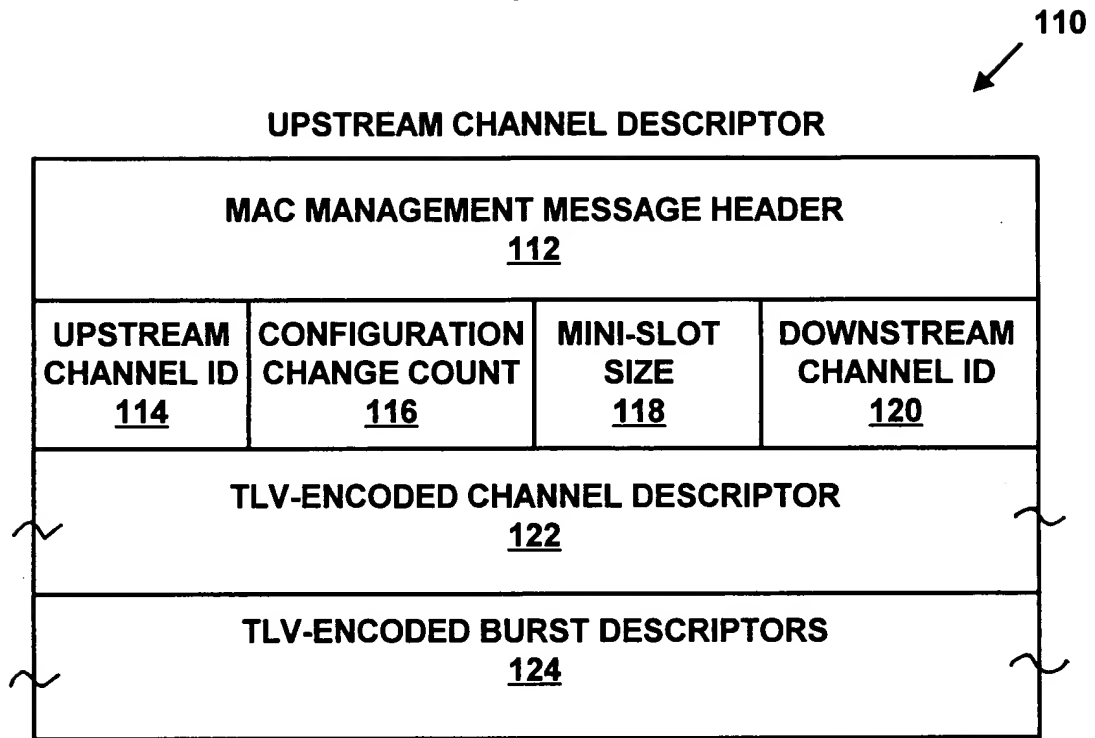
**MAP INFORMATION ELEMENTS**

100

<b>FIRST INTERVAL</b>	<b>SID <u>76</u></b>	<b>IUC <u>102</u></b>	<b>OFFSET <u>104</u></b>
<b>SECOND INTERVAL</b>	<b>SID</b>	<b>IUC</b>	<b>OFFSET</b>
<b>LAST INTERVAL</b>	<b>SID</b>	<b>IUC</b>	<b>OFFSET</b>

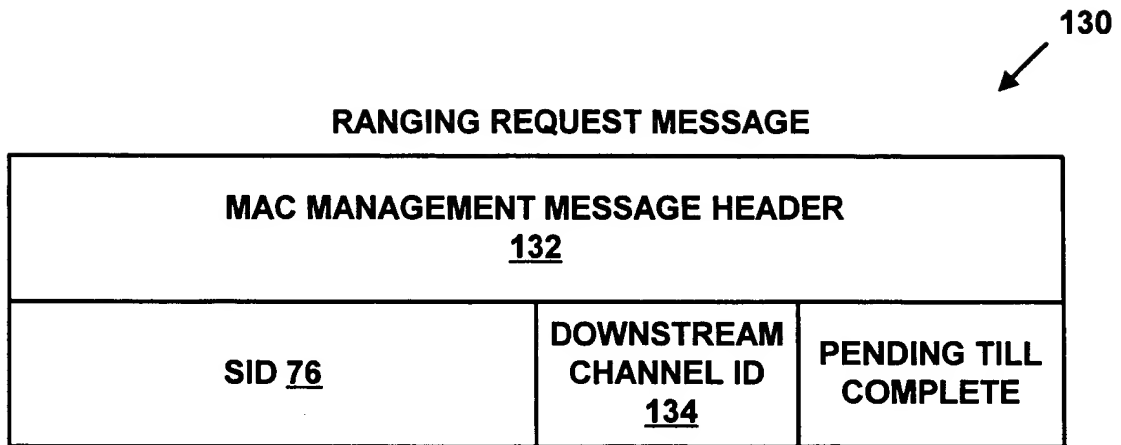


**FIG. 6**

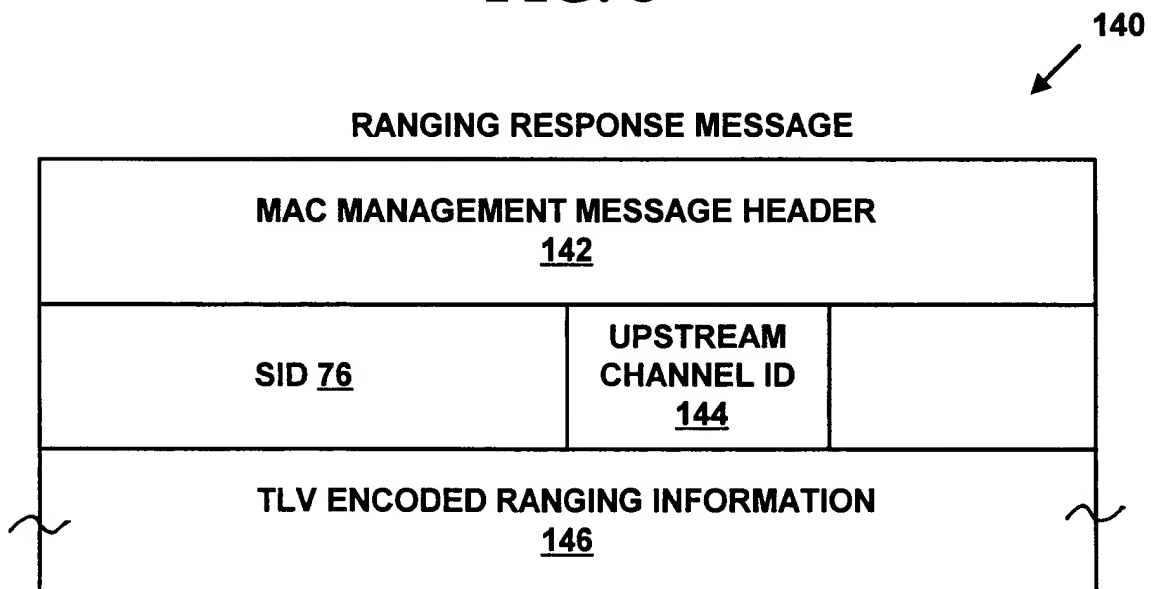




**FIG. 7**

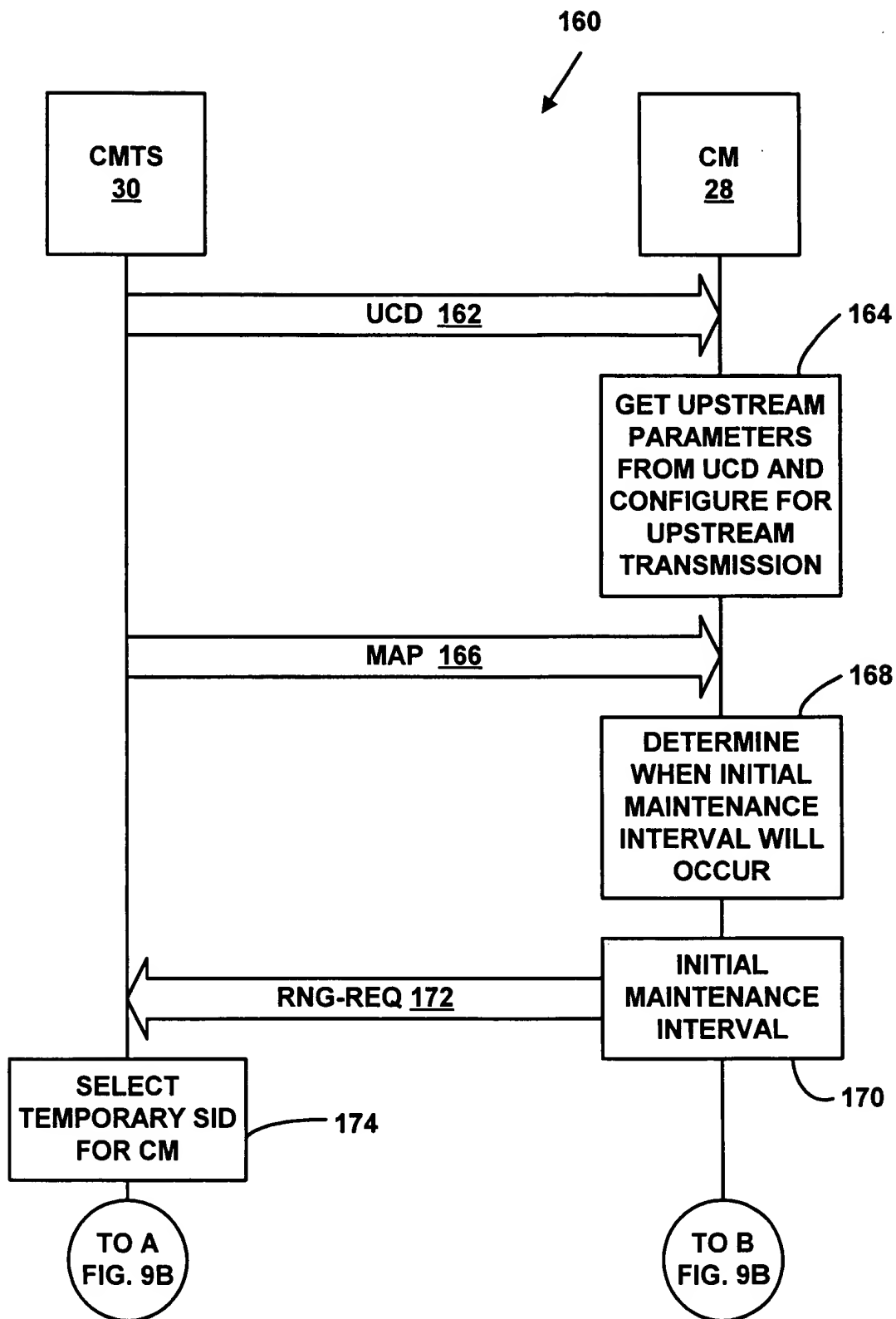


**FIG. 8**



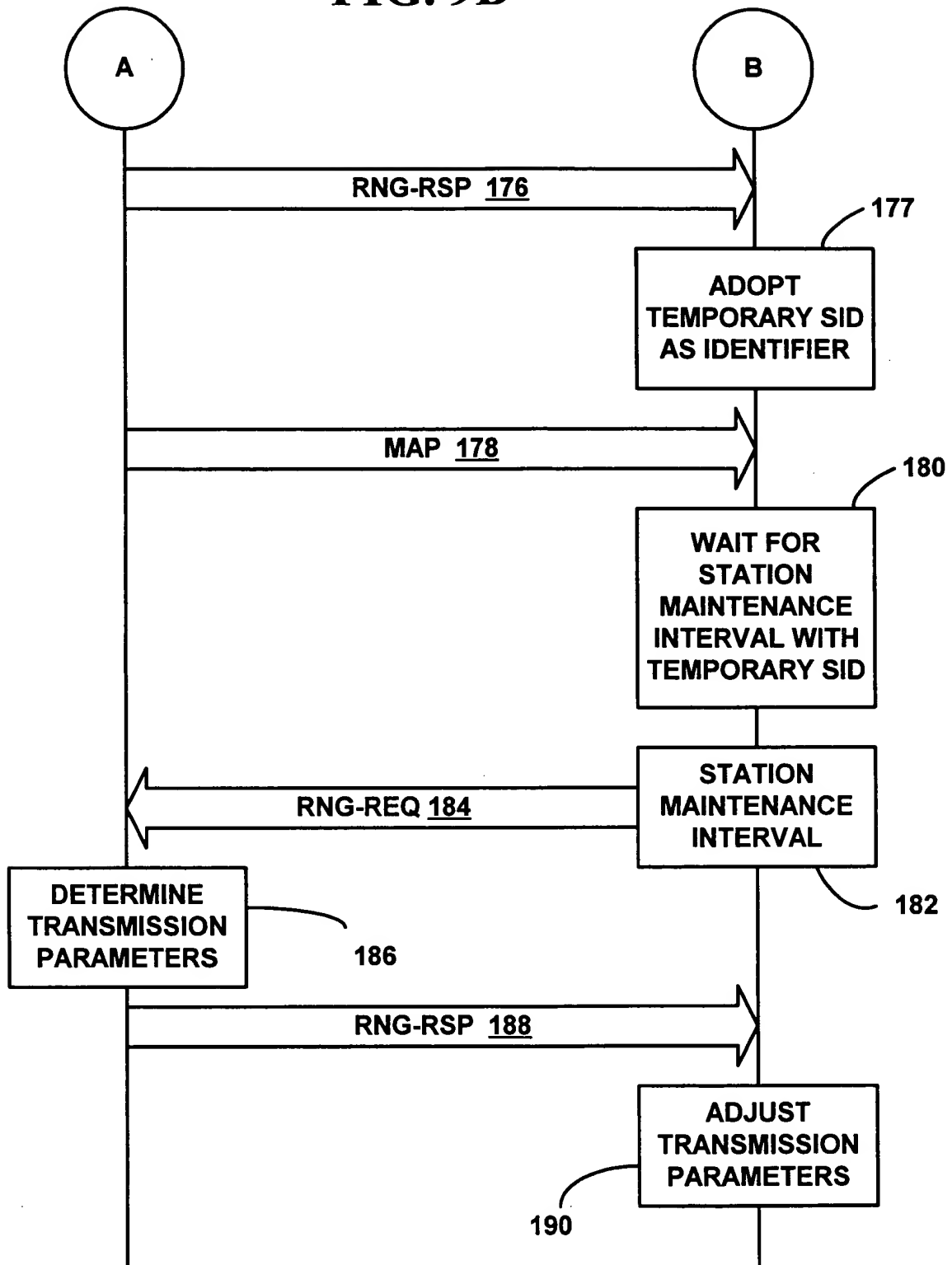


**FIG. 9A**



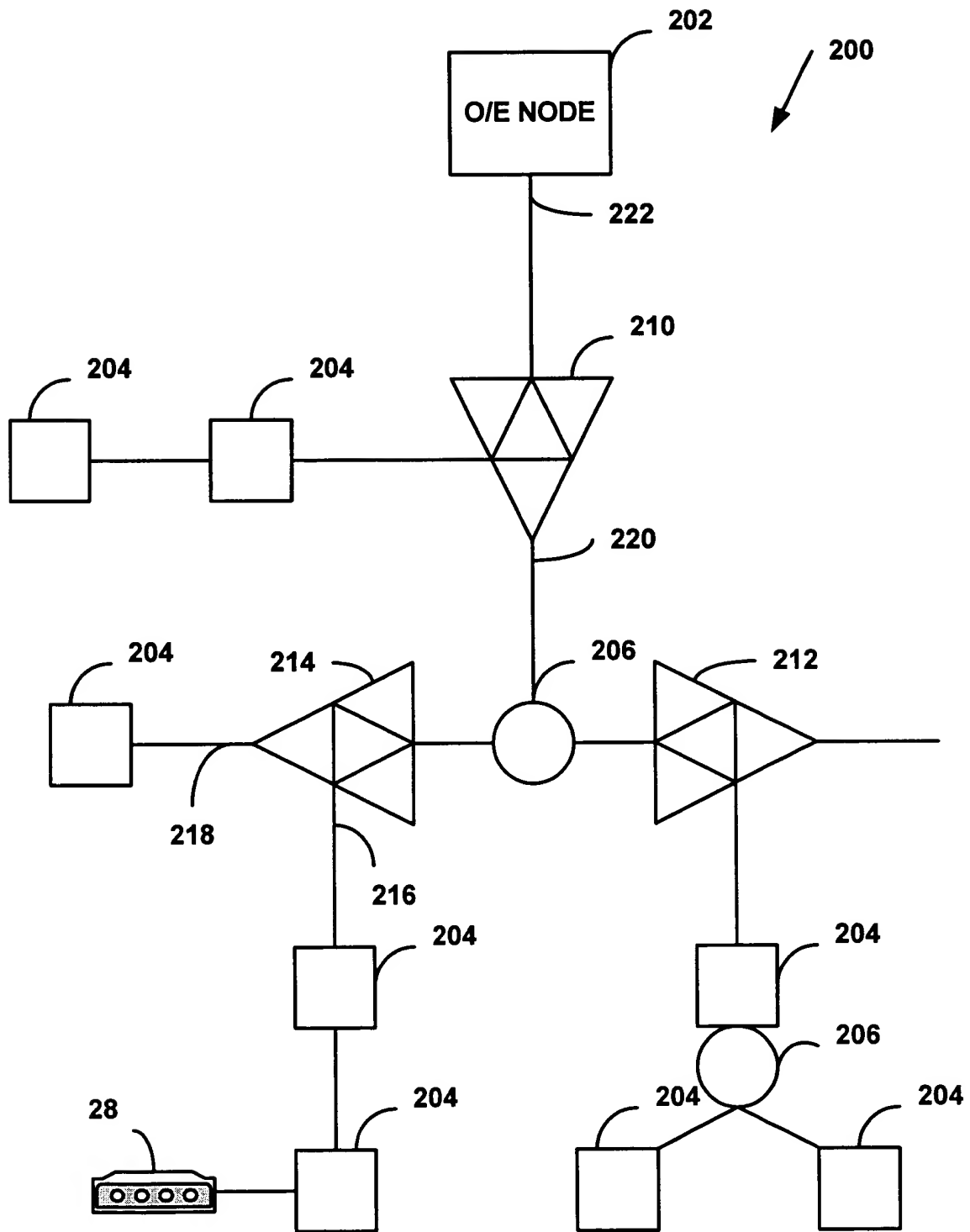


**FIG. 9B**



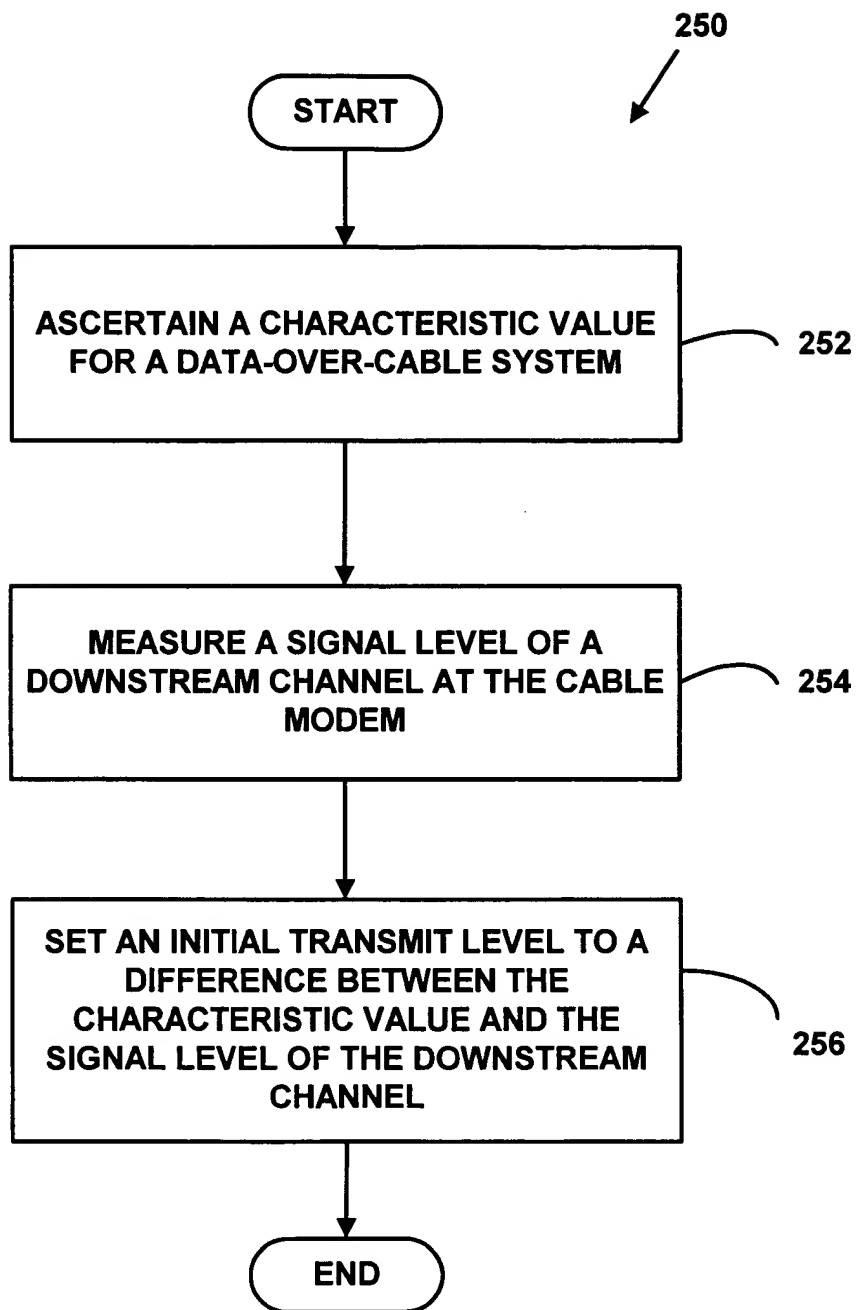


**FIG. 10**



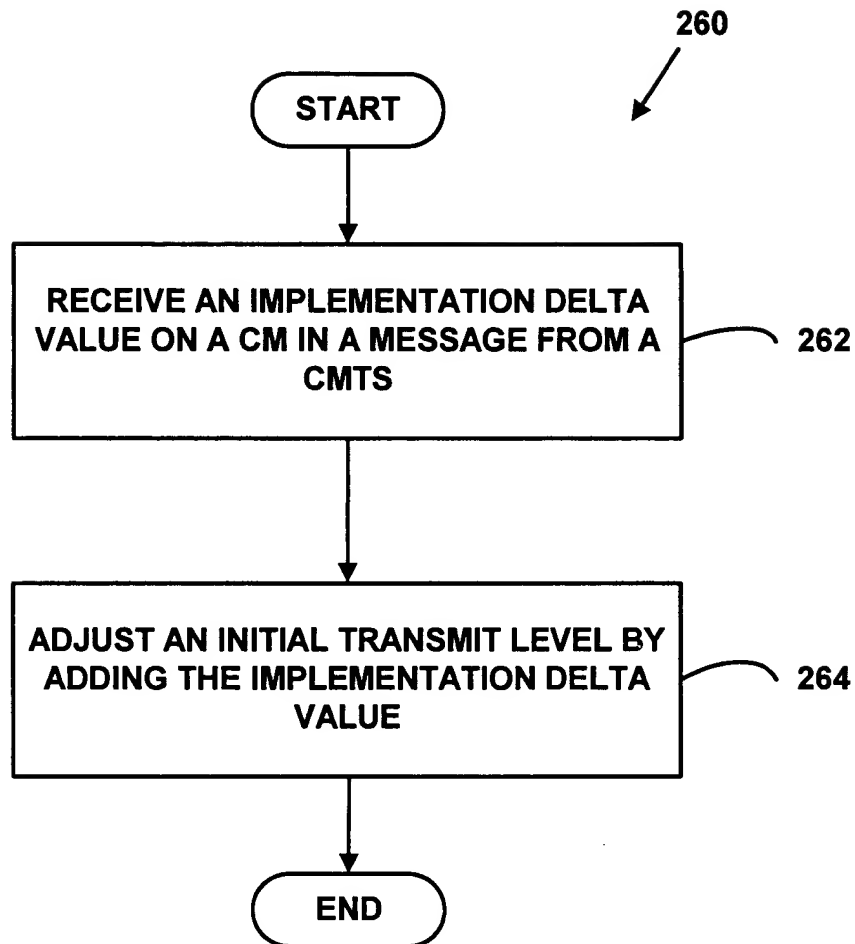


**FIG. 11**





**FIG. 12**





Hon. Commissioner of  
Patents and Trademarks

S/N

Atty MJD

Re: Applicant - Mark O. Vogel et al.

Case No. 99,818

Method for Improved Cable Modem Ranging in a Data-Over-Cable System

Sir: Please place the Patent Office receipt stamp hereon and mail to acknowledge receipt of:

- ☒ Utility Patent Application Transmittal in Duplicate
- ☒ Specification (51 sheets including claims)
- ☒ Drawings (11 sheets)
- ☒ Signed Declaration and Power of Attorney
- ☒ Filing Fee Check
- ☒ Assignment Recordal Cover Sheet and Assignment
- ☒ Other Certificate of Express Mail

EL028733964US

Express Mail No. EL028733964US

Fee Enclosed

\$ 1,180.00

Date Mailed: March 29, 2000

Respectfully,  
McDonnell Boehnen Hulbert & Berghoff  
Attorney for Applicant



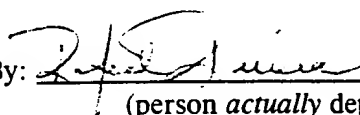
**CERTIFICATE OF MAILING BY "EXPRESS MAIL"**  
**(NEW PATENT APPLICATION)**

Attorney Docket No.: 99,818

Express Mail No. EL028733964US

Deposited March 29, 2000

I hereby certify that the attached correspondence, identified below, is being deposited with the United States Postal Service as "Express Mail Post Office to Addressee" under 37 CFR § 1.10 on the date indicated above and is addressed to the Asst. Commissioner for Patents, Box Patent Application, Washington, DC 20231.

By:   
(person actually depositing)

Patent Application of: Mark O. Vogel and Philip Robinson

Title: Method for Improved Cable Modem Ranging in a Data-Over-Cable System

- ☒ Patent Application ( 51 pages, including claims)
- ☒ Drawings (11 sheets)
- ☒ Postcard
- ☒ Utility Patent Application Transmittal in Duplicate
- ☒ Check
- ☒ Signed Declaration and Power of Attorney
- ☐ Small Entity Form
- ☒ Assignment Recordal Cover Sheet and Assignment
- ☐ Other





EL028733964US



\* EL028733964US \*

POST OFFICE TO ADDRESSEE

SEE REVERSE SIDE FOR  
SERVICE GUARANTEE AND LIMITS  
ON INSURANCE COVERAGE

Customer Copy  
Label 11-F July 1997

<b>ORIGIN (POSTAL USE ONLY)</b>		
PO ZIP Code 76105	Day of Delivery <input checked="" type="checkbox"/> Next <input type="checkbox"/> Second	Flat Rate Envelope <input type="checkbox"/>
Date In Mo. 3 Day 2000 Year 05	<input type="checkbox"/> 12 Noon <input type="checkbox"/> 3 PM	Postage \$ 15.75
Time In AM <input type="checkbox"/> PM <input type="checkbox"/>	Military <input type="checkbox"/> 2nd Day <input type="checkbox"/> 3rd Day	Return Receipt Fee
Weight 15 lbs.	Int'l Alpha Country Code	COD Fee Insurance Fee
No Delivery <input type="checkbox"/> Weekend <input type="checkbox"/> Holiday	Acceptance Clerk Initials	Total Postage & Fees \$ 15.75

<b>CUSTOMER USE ONLY</b>	
METHOD OF PAYMENT:	
Express Mail Corporate Acct. No.	<input type="checkbox"/> <b>WAIVER OF SIGNATURE (Domestic Only):</b> Additional merchandise insurance is void if waiver of signature is requested. I wish delivery to be made without obtaining signature of addressee or addressee's agent (if delivery employee judges that article can be left in secure location) and I authorize that delivery employee's signature constitutes valid proof of delivery.
Federal Agency Acct. No. or Postal Service Acct. No.	<input type="checkbox"/> <b>NO DELIVERY</b> <input type="checkbox"/> Weekend <input type="checkbox"/> Holiday

**FROM: (PLEASE PRINT)** PHONE ( )

MCDONNELL, BOEHNNEN, HULBERT &  
BERGHOFF  
300 S WACKER DR  
CHICAGO IL 60606-0000

MJD 99.818 52/638

**TO: (PLEASE PRINT)** PHONE ( )

BOX PATENT APPLICATION  
ASSISTANT COMMISSIONER  
FOR PATENTS  
WASHINGTON DC 20231-9999

**PRESS HARD.** You are making 3 copies. **FOR PICKUP OR TRACKING CALL 1-800-222-1811** [www.usps.gov](http://www.usps.gov)



2873396



AS0300 Asst. Commissioner of

020349

33135 52/638 3/28/00 1,180.00 1,180.00 .00

BAM

Check Total 1,180.00

file copy

03/28/00 AS0300

ONE THOUSAND ONE HUNDRED EIGHTY AND 00/100\*\*\*\*\*  
DOLLARS\*\*\*\*\*

\$\*\*\*\*\*1,180.00

Asst. Commissioner of  
Patents & Trademarks

file copy

MC DONNELL BOEHNEN HULBERT & BERGHOFF

20349

MC DONNELL BOEHNEN HULBERT & BERGHOFF

20349

VENDOR: AS0300 Asst. Commissioner of CHECK NO: 020349  
OUR REF. NO. YOUR INVOICE NUMBER INVOICE DATE INVOICE AMOUNT AMOUNT PAID DISCOUNT TAKEN

33135 52/638 3/28/00 1,180.00 1,180.00 .00

BAM

Check Total 1,180.00



**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**